ORIGINAL RESEARCH PAPER

Epidemiology

EPIDEMIOLOGICAL REPORT ON OUTBREAK INVESTIGATION OF AES/JE IN GAYA DISTRICT, BIHAR IN 2016

KEY WORDS: Acute Encephalitis Syndrome, Japanese Encephalitis, Chandipura Viral Encephalitis, Herpes Encephalitis

Ragini Mishra* tate Epidemiologist, State Surveillance Unit, State Health Society, Bihar *Correspondng Author

Alok Kumar District Epidemiologist, District Surveillance Unit, Jahanabad

ABSTRACT

Acute Encephalitis Syndrome (AES) and Japanese Encephalitis (JE) is a major public health problem in Bihar claiming lives of many persons especially the childrens every year. Recurrent outbreaks of AES/JE have been reported in Gaya district, Bihar in recent years. Outbreak of AES/JE in Gaya in 2016 was investigated. Epidemiological, Entomological and Environmental investigations were carried out. From 23 June 2016 till 14 July 2016, total 29 cases and 17 deaths due to AES were reported in Gaya district. Out of the total 29 cases, etiological confirmation could be done in 10 cases out of which 3, 3 & 4 cases were confirmed as JE, Herpes Encephalitis and Chandipura Viral Encephalitis respectively. This was the first ever report of Chandipura Viral Encephalitis in the State throwing insights into the new etiological agents causing the AES outbreaks. Block Wazirganj was the most affected followed by Imamganj. Fever and altered sensorium was present in 100% of the cases. Outbreak peak was observed on 24 June 2016. Per Man Hour Density (PMHD) of culex was higher when compared to other mosquito species. Culicine Larval density/dip was higher in cattle feeding containers followed by paddy fields. Most of the affected population belonged to low socio-economic strata. Awareness regarding the disease was also very less in the affected population. The study would help to identify the factors leading to the recurrent outbreaks in the region and for selection of appropriate remedial actions.

Introduction:-

Japanese Encephalitis (JE) is caused by a virus which is transmitted through the bite of infected mosquitoes (*Culex tritaeniorhyncus & Vishnui*) [1] and is one of the common cause of AES [2]. The main reservoirs of the JE virus are pigs and water birds and in its natural cycle, virus is maintained through certain mosquito species in these animals. Man is accidental host & does not play a role in JE transmission. Multiple factors like virus, bacteria, fungi, parasites and toxins may cause AES [3]. It is estimated that a population of 375 million are at a risk of acquiring AES in India [4]. Besides JE virus (JEV), other viruses that have resulted in high incidence of AES in India are Dengue virus, Entero-virus, Herpes Simplex Virus (HSV), Measles and Chandipura virus [5]. However, etiology of AES remains unknown in 68-75% of patients [6]. As per WHO, AES is defined as acute onset of fever and a change in mental status including symptoms such as confusion, disorientation, or inability to talk and/or new onset of seizures excluding febrile convulsions in a person of any age at any time of year.

The present study was done to review and assess the situation of AES/JE outbreak in Gaya, to determine the causes of current outbreak, to conduct an epidemiological and also entomological survey in some of the affected areas of Gaya, to assess the environmental and sociological factors contributing to the abundance of JE vector, to assess the current situation by district wise analysis of AES/JE outbreak and to recommend remedial measures to overcome the current outbreak and prevent occurrence of outbreaks in future.

Methodology:

This was a record based study where daily reports on AES cases in prescribed format was reported from district surveillance unit comprising of Govt Medical College & Hospitals to the State Surveillance Unit. Lab reports for JE IgM ELISA, Herpes and Chandipura viral encephalitis were also collected for recording respective cases. WHO case definition was used for inclusion of cases. Descriptive epidemiology based on time, place and person was used to analyze the outbreak trend of AES. Entomological investigations consisted of adult and larval survey as per standard protocol. Water logged places and containers were searched for the presence of culex larvae in the affected villages. Larvae were collected with the help of dippers. Three dips per sq m of breeding habitat surface area were taken. Adults were collected by 2 methods viz: Oral Aspirator and torch method by which Per Man Hour Density (PMHD) was calculated both indoors and outdoors. Total catch of mosquitoes was also done to determine species composition and its vectorial capability. The samples were sent to NIMR Ranchi for this purpose. Environmental investigations were done as per pre-planned questionnaire. Discussion was held with the District authorities and medical and paramedical staff to know the background information of the affected areas, genesis of outbreak, investigations carried out so far and control measures undertaken. Discussion was held with the physicians who treated the cases about the clinical presentation of cases, results of laboratory investigations and outcome of cases. Interview and clinical examination of some of the cases were done. Visit to the affected areas for rapid fever survey by house to house visit and collection of sera samples from suspected cases for JE confirmatory test at ANMCH, Gaya was done.

Site description/Gaya district profile: Gaya district occupies an area of 4,976 square kilometers. Total area is 4,976 km^2. It has 24 blocks & 4 sub divisions. According to the 2011 census, Gaya district has a population of 4,379,383. The district has a population density of 880 inhabitants per square kilometer. Its population growth rate over the decade 2001-2011 is 26.08% & literacy rate is 66.35%.Longitudinal extension is 84.40-85.50 east and latitudinal extension is 24.50-25.100 towards north. Principal crops grown are Paddy, wheat, lentils and potato. Sheep, Goat rearing and piggery are a major source of income. The total pig population in the district is around 1.3 Lakhs and is raised specially by Manjhi and Mahadalit community.

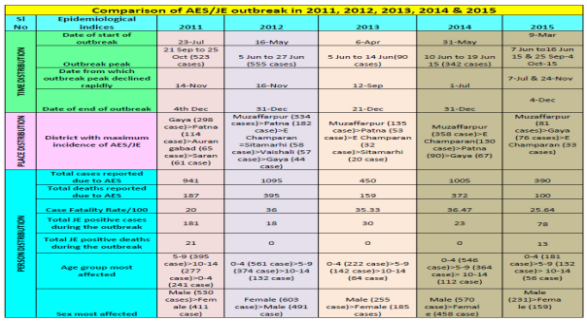
Results and Discussion:

General Observations: The team visited the affected areas in village Chakand, Chandauti block for detailed outbreak investigation. Additional Primary Health centre (APHC) Chakand had only 2 rooms out of which 1 was being used to admit and treat patients while in other room, AES ward was marked with 4 beds. The Health Staffs were also sitting in same room due to lack of space. Water logged places and containers were searched for the presence of culex larvae in the affected villages.

I) Epidemiological results

Overall 29 cases of AES were reported in Gaya till 14 July 2016. Out of 29 cases, 24 cases belonged to Gaya, 2 cases each belonged to Nawada and Jharkhand while 1 case belonged to Aurangabad. Most affected block was Wazirganj (7cases)>Imamganj (3 cases)=Guraru (3 cases)>Fatehpur (2 cases). Approximately in all the cases, most common symptoms were fever, altered sensorium and seizures. Age group most affected was 5-9 (52%)>0-4 (38%)>10-14 (10%). Males (52%) were more affected than females (48%). Outbreak peak laid on 24 June 16 when 6 cases and 3 deaths were reported.

Fig 1: Descriptive Epidemiological Analysis of AES/JE outbreak in Bihar



Comparison of AES/JE outbreak in 2011, 2012, 2013, 2014 & 2015						
Sl No	Epidemiological indices	2011	2012	2013	2014	2015
TIME DISTRIBUTION	Date of start of outbreak	23-Jul	16-May	6-Apr	31-May	3-Mar
	Outbreak peak	21 Sep to 25 Oct (523 cases)	5 Jun to 27 Jun (555 cases)	5 Jun to 14 Jun(90 cases)	10 Jun to 19 Jun 15 (842 cases)	7 Jun to16 Jun 15 & 25 Sep-4 Oct-15
	Date from which outbreak peak declined rapidly	14-Nov	16-Nov	12-Sep	1-Jul	7-Jul & 24-Nov
	Date of end of outbreak	4th Dec	31-Dec	21-Dec	31-Dec	4-Dec
PLACE DISTRIBUTION	District with maximum incidence of AES/JE	Gaya (398 case)>Patna (114 case)>Aurangabad (65 case)>Saran (61 case)	Muzaffarpur (334 cases)>Patna (182 case)>E Champaran =Sitamarhi (58 case)>Vaishali (57 case)>Gaya (44 case)	Muzaffarpur (135 case)>Patna (53 case)>E Champaran (32 case)>Sitamarhi (20 case)	Muzaffarpur (358 case)>E Champaran(130 case)>Patna (90)>Gaya (67)	Muzaffarpur (81 cases)>Gaya (76 cases)>E Champaran (33 cases)
PERSON DISTRIBUTION	Total cases reported due to AES	941	1095	450	1005	390
	Total deaths reported due to AES	187	395	159	372	100
	Case Fatality Rate/100	20	36	35.33	36.47	25.64
	Total JE positive cases during the outbreak	181	18	30	23	78
	Total JE positive deaths during the outbreak	21	0	0	0	13
	Age group most affected	5-9 (395 case)>10-14 (277 case)>0-4 (241 case)	0-4 (561 case)>5-9 (374 case)>10-14 (132 case)	0-4 (222 case)>5-9 (142 case)>10-14 (64 case)	0-4 (546 case)>5-9 (364 case)> 10-14 (112 case)	0-4 (181 case)>5-9 (132 case)> 10-14 (56 case)
	Sex most affected	Male (530 cases)>Female (411 case)	Female (603 case)>Male (491 case)	Male (255 case)>Female (185 case)	Male (570 case)>Female (458 case)	Male (231)>Female (159)

Fig 2: Date wise AES/JE outbreak situation Gaya in 2016

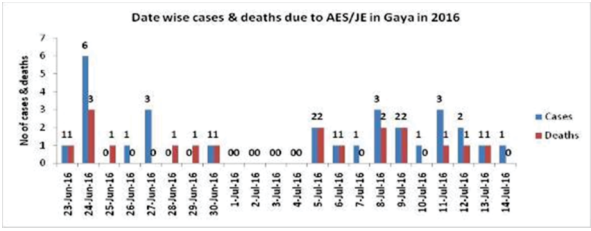


Fig 3: Place wise distribution of AES/JE in Gaya

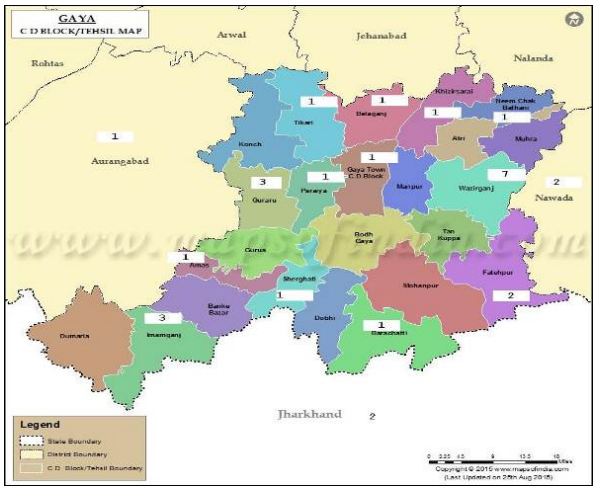


Table 1: Person wise distribution of AES/JE in Gaya

Age Group	Frequency	Percentage
0-4	11	38
5-9	15	52
10-14	3	10
15 & 15+	0	0
Total	**29**	**100**
Sex	**Frequency**	**Percentage**
Male	15	52
Female	14	48
Total	**29**	**100**

Table 2: Institution wise Status of AES/JE in Gaya

Institutional Status of AES cases in Gaya		
1	**Total AES cases till 14 July 16**	29
a	Discharged	8
b	Death	17
c	LAMA	4
2	**Total AES Unknown**	19
3	Total AES confirmed	10
a	JE positive Case/Death	3/1
b	Herpes Encephalitis (HSV) Case /Death	3/2
c	Chandipura Virus Encephalitis (CHPV) Case/Death	4/2
4	**Total AES cases belonging to Gaya**	24
5	**Total AES Cases reported in Gaya & belonging to other districts/State out of total AES cases**	5
a	Nawada	2
b	Aurangabad	1
c	Jharkhand	2
6	**No of Blocks affected in Gaya**	14
7	**Most affected blocks in Gaya**	Wajirganj (7)>Imamganj (3)=Guraru (3)>Fatehpur (2)

Table 3: Clinical Profile of AES/JE cases (n=15)

Clinical profile of AES/JE cases (n=15)		
Fever	15	100%
Altered Sensorium	15	100%
Vomiting	8	0.01%
Headache	5	33%
Seizures	15	100%

II) Entomological results:

Different species of mosquitoes were collected from above indoor habitats during dusk hours which were identified as under: Culex: 50; Anopheles: 12; Aedes: 2. Overall Per Man Hour density in order of prevalence are: Culex>Anopheles> Aedes. Maximum number of collection for Culex was made from Cattle shed while for Anopheles and Aedes it was from Human Dwellings. For larval survey, collection from breeding areas like Paddy field, cattle feeding containers, other water containers & pots were searched. Anopheline, Culicine as well as Aedine larvae could be identified. Density per dip was maximum in cattle feeding containers > paddy field> other water containers > pots.

Table 4 A: Per Man Hour Density of Mosquitoes in Village Chakand

Per man hour density					
Block Chandauti, Village Chakand					
Mosquito species	Indoor				Outdoor
	HD	CS	MD	PMHD	PMHD (Plantations, Bushes etc)
Culex	9	16	12	0.82	1
Anopheles	6	4	2	0.26	0.8
Aedes	2	0	0	0.04	0

T=45 min

Table 4 B: Details of Mosquito breeding Sites in village Chakand

Details of Mosquito Breeding sites	No. Checked	No. found positive	Avg Density/Dip(3 dips done)	Name of the species identified
Paddy field	4	3	8	Culex
				Anopheles
Cattle feeding containers	5	5	16	Aedes
				Culex
Household water containers	10	4	6	Aedes
				Anopheles
Pots/vases	5	1	3	Aedes
Coconut/Palm Shells	10	4	2	Aedes

III) Environmental & Sociological Observations and Results:

Most of the affected population belonged to low socio-economic strata, with most of the houses being semi –pucca/Kutcha category. Sanitation and hygiene in affected areas were also poor. Majority of them were illiterate and unaware of the cause of the disease. Awareness regarding disease control & prevention was also very less.

Table 5: Socio-demographic Profile of respondents

Socio-demographic characteristics of respondents (50 approx)		
Characteristics	**Male**	**Female**
	n=20	**n=30**
Age (years)		
18-30	5	14
>30	12	19
Educational status		
Literate	10	5
Illierate	15	20
Occupation		
Working	20	5
Non working	10	15
Family Type		
Nuclear	15	17
Joint	10	8
Type of House		
Pucca	8	7
Semi-Pucca/Kutcha	15	20
Water Supply		
Safe	5	12
Unsafe	16	17
Waste disposal		
Compost pits	7	7
Covered pits	0	0
Throwing discriminately	16	20
Drainage		
Open	20	20
Underground	0	0
Soakage pits	5	5

Table 6: Awareness & knowledge regarding selected mosquito - borne diseases

Characteristics	No. of respondents (n=50 approx)
Sources of information	
TV	15
Radio	18
Newspapers	2
Health Care Providers	10
Others	5
Serious problem in area	
Yes	45
No	5
Breeding places	
Ditches	16
Ponds	4
Vehicle tyres	0
Stagnant Water	22
Coconut shells	0
Others	8
Causative agents	
Mosquito bite	20
Drinking dirty water	8
Overwork/sun exposure	5
Food	0
Others	6
Don't know	11
Disease transmitted by mosquitoes	
Malaria	20
Dengue	10
Chikungunya	1
Filaria	6
Others	4
Don't know	9
Control measures	
Environmental	10
Chemical	30
Biological	5
Integrated	0
Don't know	5

Conclusion:

Overall, 29 cases & 17 deaths were reported due to AES/JE in Gaya from 23 June to 14 July 2016. Case Fatality Rate/100 due to the disease was 59.Out of 29 AES cases, 3 cases & 1 death were confirmed as JE, 3 cases & 2 deaths as Herpes Encephalitis and 4 cases and 2 deaths as Chandipura Virus Encephalitis (CHPV). This was for the first time that CHPV Encephalitis has been reported in the State that needs further investigation and exploration. Age group most affected is 5-9>0-4. Males were more affected than females. Wajirganj block was most affected >Imamganj>Guraru. Entomological investigations revealed that PMHD of Culex was higher when compared to other mosquitoes lie Anopheles and Aedes favouring transmission of JE. Most common breeding sites for larvae were cattle feeding containers>paddy fields. As per informants of the affected areas, only focal spray/fogging was done in affected area once. Water birds as well as amplifying hosts, pigs were also found in large numbers in affected areas. Most of the affected population belonged to low socio-economic strata, with most of the houses being semi –pucca/kutcha category. Sanitation and hygiene in affected areas were also poor. Majority of them were illiterate and unaware of the cause of the disease. Awareness regarding disease control & prevention was also very less. With the advent of monsoon season, water logging in various places including paddy field might further aggravate JE transmission in future if appropriate steps are not taken on immediate basis. There is urgent need for fogging in JE affected areas at regular intervals as well as undertaking source reduction activities. Intensive IEC activities and awareness creation among community through Health Workers should also be undertaken along with enhancing fever surveillance and it's reporting on daily basis for early identification of suspected cases for prompt treatment and control.

Recommendations:

i) Adequate and timely availability of medicines, kits, logistics, equipments etc.
ii) Enhancing fever surveillance and it's reporting through Health Workers on daily basis for early identification of suspected cases for prompt treatment and control
iii) Daily reporting of suspected cases should be shared with the State by the MCH.
iv) Measures for source reduction should be immediately implemented. Use of kerosene, diesel oil in water logged places on weekly basis by community participation should be undertaken. Alternatively, spray of larvicide may be undertaken for source reduction.
v) District RRT should be activated for investigation & containment of the outbreak. This should include the Animal Husbandry Department as well. Awareness on covering the pigs sheds residing along with human population with mosquito/mesh nets may be undertaken by Animal Husbandry Department in coordination with Health Department.
vi) PHCs should also be made well equipped to manage any outbreak. For this Technical Malathion, fogging machines, health education materials, preliminary lab investigation and transportation of cases to referral Centres should be made available before the transmission season.
vii) Vector & larval surveillance should be carried out throughout the year to map the vector density & larval breeding sites. For this VBD consultants/KTS should be made well equipped and trained.
viii) Case management through early diagnosis & prompt treatment must be done. Camp based approach for active case search of AES/JE must be undertaken.
ix) JE Vaccination of susceptible population should be carried out on urgent basis.
x) Awareness of Community through IEC, IPC & BCC must be done for success of intervention methods.
xi) All districts adjoining the districts where a case of JE/AES has been recorded should be made alert & an eye on all the AES

cases should be kept for timely referral & cases management.

Photographs of Field visit:

APHC Chakand Gaya

AES ward in APHC

Larval breeding sites

Larval breeding sites; Water birds &Pigs near house holds in affected area

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[2] NB1, DM and RM, NB2 conceptualized the study, participated in the design of microbiological and epidemiological portion, facilitated the overall study activities and revised the manuscript critically

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