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An Epidemiological Investigation of Dengue Outbreak in Shri Muktsar Sahib District, Punjab, India 2012.

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Abstract: Dengue is a serious and worldwide spreading illness caused by the mosquito Aedes aegypti bite. Seasonal variation in dengue outbreak has been noticed by many years and it is a systematically increase. The study was designed to apply district epidemiological field that is time, place and person. With the other epidemiological determinant including finding the aetiology behind dengue outbreak. Data was collected at Shri Muktsar sahib with the reported cases of dengue at Guru Gobind Singh Medical College including the convenient sampling technique with total enumeration. Case confirmation was done by serological examination for dengue fever. Out of 812 reported cases 399 were positive for dengue. Dengue outbreak caused higher morbidity which might have resulted in morbidity and fatality of dengue fever in district At that point the situation was turned in to outbreak. It has been seen at Shri Muktsar Sahib District, from being a sporadic illness, outbreaks of dengue has now become a regular occurrence. The reason behind this outbreak is water storage and improper sanitation.

Key Words: Dengue, Epidemiological Investigation, Outbreak.

I. INTRODUCTION

Dengue is a type of vector (mosquito borne disease) which is transmitted by the mosquito bite with one of the four serotype[.1]
Dengue is one of the specific mosquito-bite diseases in the entire world it may collectively response for morbidity, mortality, fatality and economic growth [1], specifically in the tropics, including greater than 1/3rd population worldwide for those people who are living in areas at risk for dengue[2,3]. In spite of account for sporadic illness, dengue outbreak and epidemic is now a regular seasonal epidemic of epidemiological importance.
Dengue is caused by the mosquito that is *Aedes aegypti*, the type of peridomestic mosquito, which acts as one of the principal vector in transmission of the dengue virus. The breeding of Aedes aegypti is highest during the pre and post monsoon periods [5].
Primary cause of dengue is the bite of *Aedes aegypti* and *Ae. Albopictus*. Because of the approximately 7-day presence or viremia in human body[6].
Dengue fever may be caused by the infective serotype of any four dengue virus (DENV-1, -2, -3 and -4) and infection of all four will give lifelong immunity as IgM. Then further subsequent infection will increase the risk of severity of dengue fever with symptoms with the development of IgG antibody for serological examination[7].
More than 20,000 cases were reported as positive dengue cases in the year 2011 with which more than 4,000 cases were reported as positive case for dengue only in Punjab, India. And same way major outbreak was reported in various other part of country[8].

A. OBJECTIVE

1) To apply descriptive epidemiology in the field in relation to person, place and time and formulate practical recommendation for control of such outbreak in future.
2) To find the aetiology behind dengue outbreak.

3) To analyse the clinical symptoms associated with dengue fever
4) To investigate entomology behind dengue outbreak.

B. MATERIAL AND METHOD

Prior approval from the civil surgeon of Shri Mukhtsar Sahib and informed consent from reported cases was obtained. Data was collected including line listing, clinical history and laboratory test performed for each case from the passive agencies and also from the patient directly. First of all area of prioritization was done and according to which different teams were prepared, focus was made to cover first area. After getting the line listing of all cases an outbreak curve is prepared to describe the development of the outbreak over time, plotted cases on a map to understand the geographical distribution of the disease, and calculated the incidence by age and sex using population denominators, with the help of census data the relative proportion of population was calculated in different age group and was applied to the population of 2011(as per population received according to census 2011) and proportion of population of different age group was calculated. 215 patients affected with dengue infection and cases were increasing day by day, these all cases were reported from passive units like civil hospital, private clinic and multi specialist hospital and these all passive agency are attached with the IDSP unit Shri Muktsar Sahib and from here data was taken including line listing, clinical history and laboratory test performed for each case from the passive agencies and also from the patient directly. On behalf of this data, First of all area of prioritization was done and according to which different teams were prepared, focus was made to cover first area which was highly suffering with dengue infection. Each team consists of male and female multi-purpose worker which were supervised by sanitary /surveillance inspector.

Serological test examination at Guru Gobind Medical College, Faridkot and hospital was proffered, Faridkot. It was kept in mind that the history of fever should be of at least >5 days, so that the antibodies appears in blood against dengue antigen which would be confirmed by Mac Elisa kit.

Samples were tested with the PanBio Dengue IgM Capture ELISA. All the tests were carried out as per the manufacturer's instructions and were able to provide information on both dengue IgM and IgG responses.

For entomological investigation Immature search surveys were carried out in severely affected colonies to estimate the Aedes larval breeding indices such as house index (HI), container index (CI) and Breateau index (BI). The areas surveyed for *Aedes* mosquito breeding places.

C. SETTING

The survey in Shri Muktsar Sahib District of Punjab, India which is stated in North India, having a population of 1.1 million in 2011. Data was collected from 15th October 2011 to 25th October 2011. About 68% of the district population resided in rural areas and 32% were residing in urban area. This district located in North India has a warm 32 degree Celsius climate with maximum humidity between 70 and 80 % within turning in winter, with limited rainfall. National dengue control program was launched with the national vector borne disease control program in 2003-2004 India.

D. SAMPLING

Sample size was calculated at 812 serum samples to estimate the outbreak within 20% of true value at 5% significance level at Guru Gobind Singh medical college and hospital, Faridkot, all these sample were taken from suspected cases which matched with the clinical case definition of Dengue Fever by WHO.

The sample size was calculated from urban and rural Population of Shri Mukhtsir Sahib. Sampling was done by convenient sampling technique through total enumeration.

E. FIELD PROCEDURE

Field and laboratory staff was trained in survey procedures at Guru Gobind Singh medical college and hospital, Faridkot, Shri Muktsar Sahib. All suspected cases that were suspected by others health care agencies were examined by Serological test through ELISA test through Mac Elisa kit PanBio Dengue IgM Capture ELISA and IgM ELISA Kit for IgM and IgG responses respectively.

For entomological investigation Immature search surveys were carried out in severely affected colonies to estimate the Aedes larval breeding indices such as house index (HI), container index (CI) and Breateau index (BI). The areas surveyed for *Aedes* mosquito breeding places.

Each registered individual, irrespective of presence or absence of symptoms of Dengue fever was also subjected to Serological screening by trained laboratory staff.

F. LABORATORY INVESTIGATION

Direct serological examination was done for each sample by collection of blood sample collection.

Laboratory diagnosis methods for confirming dengue virus infection involved detection of the virus, viral nucleic acid, antigens or

antibodies, or a combination of these techniques. After the onset of illness, the virus can be detected in serum, plasma, circulating blood cells and other tissues for 4–5 days. During the early stages of the disease, virus isolation, nucleic acid or antigen detection can be used to diagnose the infection. At the end of the acute phase of infection, serology is the method of choice for diagnosis. Dengue infection was divided into two parts, Primary infection and secondary infection. Primary infection will be with the resistance of IgM antibodies that is slow and specific antibodies develop with the person who is infected first time with dengue fever virus. These antibodies are detectable in 50% of patients by days 3-5 after onset of illness, increasing to 80% by day 5 and 99% by day 10. IgM levels peak about two weeks after the onset of symptoms and then decline generally to undetectable levels over 2–3 months. IgM antibodies can be detected through ELISA test through Mac Elisa kit & PanBio Dengue IgM Capture ELISAAnti-dengue serum IgG is generally detectable at low titres at the end of the first week of illness, increasing slowly thereafter, with serum IgG still detectable after several months. That can be detected with the patients who are infected second time. IgG antibodies were detected through IgM ELISA Kit.

A range of laboratory diagnostic methods has been developed to support patient management and disease control. The choice of diagnostic method depends on the purpose for which the testing is done (e.g. clinical diagnosis, epidemiological survey, and vaccine), the type of laboratory facilities and technical expertise available, costs, and the time of sample collection.

All private and government passive unit, where large number of patients visit sample of dengue suspected cases were taken and sent for serological examination to Guru Gobind Medical college and hospital , Faridkot. It was kept in mind that the history of fever should be of at least >5 days, so that the antibodies appears in blood against dengue antigen which would be confirmed by Mac Elisa kit .Dengue virus specific IgM antibody tends to appear\early during the course of disease and allows for a provisional diagnosis of dengue to be made from a single serum sample. Detection of dengue IgM antibodies is an easier method of diagnosing DF as compared to other classical serological methods like haemagglutination inhibition, neutralization a complement fixation tests. Samples were tested with the PanBio Dengue IgM Capture ELISA. All the tests were carried out as per the manufacturer's instructions and were able to provide information on both dengue IgM and IgG responses.

c) Environmental investigation:

Investigation of the area was done where the dengue cases were reported to find the environmental linkage of dengue outbreak. It was observed that the water supply was for short duration, so people use to store water for drinking and other purposes, People stored water in the containers like cement cisterns, cement tank and plastic drum. Some of the Peri- domestic containers like mud tubs, grinding stones, metal container were also used and cement cisterns were very common to store water. These opened containers were the potential source of the outbreak.

d) Entomological investigation:

Immature search surveys were carried out in severely affected colonies to estimate the Aedes larval breeding indices such as house index (HI), container index (CI) and Breateau index (BI). The areas surveyed for *Aedes* mosquito breeding places were Tibbi sahib road, Mohan lal colony, Gandhi colony, Abhohar road, Near DAV school(Maur road) , In these areas, *Aedes* survey was carried out in and around those houses from where suspected dengue fever/DHF cases had been reported. Houses were searched for *Aedes* mosquito's larvae in various water collections/containers as per single larva technique.

II. DEFINITION

Dengue: Dengue is an important mosquito-borne disease in the world in terms of morbidity, mortality and economic costs1, especially in the tropics, with more than 2/5th of the world's population living in areas at risk for dengue. From being a sporadic illness, outbreaks of dengue have now become a regular occurrence worldwide.

Epidemiological Investigation: A disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season. An outbreak may occur in a restricted geographical area, or may extend over several countries. It may last for a few days or weeks, or for several years.

Statistical Investigation

The data were digitalized by the independent data entry operators after checking and correcting the data collected on cards. The data so entered were matched and the errors rectified by re-entry of the records by anther independent operators. This procedure of checking, matching and re-entry of records was repeated two times to set right all errors.

Statistical analysis was done including person wise distribution, time wise distribution, according to clinical symptoms, laboratory results, environmental results, entomological results. Including the descriptive statistics.

III. RESULTS

Through Descriptive analysis

The surveillance data for the Shri Muktsar sahib district which was received of period 2010-2011 confirmed the unusual increase in incidence of dengue, which caused outbreak in year 2011 and turned into outbreak. There was presence of single dengue positive case in year 2011 but at the end of December 2011 the total numbers of confirmed dengue cases were increased to 399. Descriptive epidemiology was applied and person, place and time wise result obtained.

Person wise results:

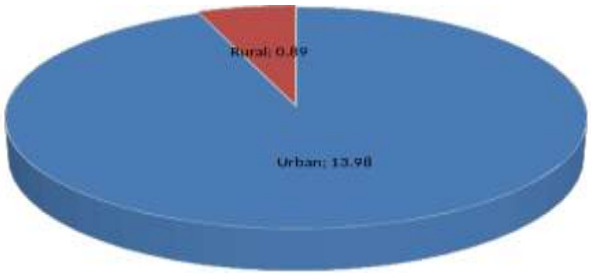
During the year 2011 812 serum samples were examined and analysed up to December 2011 at Guru Gobind Singh Medical College & Hospital, Faridkot, all these sample were taken from suspected cases which matched with the clinical cases.. Out of these samples, 399 (49.13%) were found positive for dengue virus infection. The age distribution of confirmed cases of DF is given in (**Table 1)**.

Incidence of dengue was maximum in age group 40-59 years (8.72 per 10000 populations) followed by age group 20-39 years (6.89 per 10000 population) and >60 age group (4.50 per 10000 populations) and was least was in age group 0-19 years (0.844 per 10000 population). Incidence was maximum in males (5.89 per 10000 population) then females (2.76 per 10000 populations).

Table1 :

Age wise Distribution of the Incidence of dengue outbreak in Shri Muktsar Sahib district ,Punjab, India 2011					
Demographic charateristic	Age group	Population	Cases	Incidence (per10000population)	Deaths
Age	0-19	384189	34	0.884	0
	20-39	286986	198	6.89	0
	40-59	149382	130	8.72	0
	>60	82145	37	4.504	0
Sex wise Distribution of the Incidence of dengue outbreak in Shri Muktsar Sahib district ,Punjab,India 2011					
Sex	Male	476300	281	5.89	0
	Female	426402	118	2.76	0

Place wise Results: It was found that incidence was higher in urban region then rural area of Shri Muktsar Sahib District in year 2011**(**Figure.1):



Time wise Results: Seasonal trend showed that there were no positive cases from January to April in year 2011; the infection started spreading on 17 May 2011, peaked in October and after epidemiological investigation and control measure there was fall in number of cases and it tapered by December **(**Figure**).** On analysing data of three year it was found that cases were peaked during October month and an increasing trend of incidence year after year.

Figure: 2 Cases in December

a) Clinical Results **:** N=399

Table 2 clinical presentation of confirmed cases of dengue at Shri Muktsar Sahib District, Punjab, India

Symptoms	**Number**	**(%)**
Fever	399	100
Myalgia	300	75.19
Vomiting	152	38.09
Headache	168	42.1
Abdominal pain	120	30.07
Skin Rash	69	17.29
Petechiae	28	7.01
Breathlessness	4	1.002
Diarrhea	40	10.02
Altered sensorium	4	1.002
Ecchymosis	14	3.5
Gum bleeding	12	3.002
Hematemesis	7	1.75
Epistaxis	6	1.5

The clinical sign and symptoms of all dengue confirmed cases were taken from all hospital records during survey. The most clinical common presentation was fever 399 (100%), followed by myalgia 300 (75.9%), headache 168 (42.1%) ,vomiting 152 (38.9%), and abdominal pain 120 (30.07%). The most common hemorrhagic manifestation was petechiae 28 (7.01%). %).(table.1) Thrombocytopenia was found in 168 patients (42.1%), of which 28 (7.01%) developed hemorrhagic manifestations in the form of Petechiae, bleeding gums and hematemasis. The platelet count ranged between 10,000 and <100000/mm3. None of the patients had the features of DSS and no death was recorded in any of these patients.

b) Laboratory Results:

Out of 812 samples sent to sentinel surveillance laboratory established at Guru Gobind Singh Medical College and hospital, Faridkot 399 cases were found confirmed through Mac Elisa kit.

c) Environmental Results:

It is well known that there is always a big role of environment in the Ades aegypti
Outbreak and it was seen in Shri Muktsar Sahib Outbreak where the people use to
keep cement cisterns(Image A,B) drums, overhead tanks, jars and bucket (Image C) for storing water due to insufficient supply of water for short duration. On examination, it was found that these entire containers were containing A. ageypti larvae. A complete campaign was done. For emptying all these water storing containers with IEC activities were performed. Due to this campaign larva habitat were completely destroyed and there was sharp decrease in the dengue fever cases. Weekly routine was adopted in emptying and cleaning of all containers.

Images of containers found positive for Ades aegypti larva.

(A)

(B)

(C)

e) *Entomological Results*

During the survey a total of 70 houses/ premises were searched for *Aedes* breeding and 24 were found positive (House Index

34.28 %). Similarly, a total of 80 containers were searched and 27 were found positive (Container Index 33.7%).These indices were found to be higher than the critical index reported for dengue/DHF outbreaks. The bulk of *Aedes* breeding sites compromised of cement cisterns. Other containers found positive for *Aedes* breeding was tin/plastic containers, flower vases, earthen pots, plastic buckets, and etc.The entomological investigation revealed a significantly higher House Index, ContainerIndex and breteau index for Aedes aegypti mosquito, a proven vector of DF / DHF. One more reason behind the high container index was that most of container were not covered due to which breeding was propagating. These all receptacles were not temporary so single case of dengue turned into outbreak in 2011. The presence of this vector mosquito in Punjab state has already been documented. However, higher larval indices of *Aedes aegypti* were found during the present investigation, thus indicating that the speci is well established in Shri Muktsar Sahib.

Table 3: Aedes larval breeding indices recorded in different localities of Shri Muktshar Sahib district, Punjab India, 2011

Sr.No.	Locality	Total House checked	Total Container checked	House positive	Container positive	HI	CI	BI
1	Tibbi sahib road	16	20	8	9	50	45	56.3
2	Gandhi colony	14	12	4	3	28.5	25	21.4
3	Abhohar road	19	24	8	7	42.1	29.1	36.8
4	Near DAV school, Mour road	10	8	2	3	20	37.5	30
5	Mohal lal street	11	16	2	5	18.1	31.3	45.4

IV. DISCUSSION

Sri Muktsar Sahib lies between 30° 69' and 29° 87' latitude and 74° 21' and 74° 86' longitude [10].

Environmental investigation: Physiographical the area has no river and is covered extensively by the canal net work of Sir hind feeder canal to meet the irrigation and drinking water needs of the people. It was found that most of the houses were of sub standard and not well planned, Due to acute shortage of water, Households typically continue to store water because water supplies are not reliable. With such water storage, comes the concomitant problem of A. Aegypti breeding and the increased risk of dengue infection. Dengue is a type of seasonal disease which occurs by mosquito bit and increasing in trend with the weather changes similar results were shown by the other study Gupta N [9]. Which shows that dengue is seasonally increase with the change in weather.

CONCLUSION

Community awareness, early diagnosis and management and vector control measures need to be strengthened, during peri-monsoon period, in order to curb the increasing number of dengue cases (table-1).

Conflict of Interest None

Author contribution

Protocol development Data management and analysis: Dr. Gurmeet Singh & Suman Lata. Paper writing: Dr. Gurmeet Singh & Suman Lata. Final approval: Dr. Gurmeet Singh & Suman Lata

Recommendation

1. Weekly emptying and clearing of all containers
2. Covering of all containers
3. Use of syntax covered plastic tanks for the storage of water.
4. Increase supply time of water to localities.

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LIMITATION

1) we were not able to get the details regarding the complication associated with dengue fever
2) In entomological investigation no vector surveillance method was used.
3)

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