



CONTROL OF VECTOR BORNE DISEASES - PRACTICAL INSIGHT FOR STRATEGIC MANAGEMENT

Community Medicine

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ABSTRACT

Background – Vector borne diseases are major public health concern in Mumbai. A tertiary hospital reported increased number of cases of dengue and a death of resident doctor living in campus, in spite of dengue control measures going in full-swing in city. Project was initiated to do environmental mapping, source and reservoir identification, inter-sectoral coordination and contain the outbreak.

Methods – An intensive search for mosquito breeding sites was done by five teams of doctors in and around campus of hospital including hostels to quickly contain the outbreak.

Results – Mosquito breeding was observed in overflow aperture of wash-basins of hostel. This was an unusual site formed due to peculiar design of wash-basin.

Conclusion – Dengue positive patients are taking treatment on OPD & IPD basis. Probability of mosquitoes carrying virus is high. One has to be vigilant about known as well as new potential breeding sites and take prompt action to contain them.

KEYWORDS

Outbreak investigation, Dengue, Entomological Surveillance.

Introduction:

An estimated 50 million dengue infection occur worldwide annually and about 5,00,000 people with dengue haemorrhagic fever require hospitalization each year. Epidemics of dengue are increasing in frequency. Rapid urbanization, lifestyle changes, deficient water management and improper water storage practices in urban, peri-urban and rural areas lead to proliferation of mosquito breeding sites. India comes under Category-A countries for dengue where dengue is a major public health problem. It is a leading cause of hospitalization and death among children. There is hyper-endemicity with all 4 serotypes circulating in urban areas and it is spreading to rural areas also. In India, during 2014 about 40,425 cases were reported with 137 deaths. The case fatality rate was 0.33%. Highest number of cases, 8425 with 54 deaths was reported from Maharashtra. The disease has a seasonal pattern, i.e. the cases peak after monsoon.^[1]

Mumbai lies on Konkan, west coast of India (18°58'30"N, 72°49'32"E), spread over an area of 437 km², holding a population of around 12 million. Climate of Mumbai can broadly be classified into two — humid and dry. The city gets south-west monsoon which rains in June to September with peak rains occurring in July. Occasionally, north-east monsoon showers occur in October and November. The average total annual rainfall is 1466 milli-meters in Mumbai, and 2,457 milli-meters in suburbs. The average maximum temperature is 31.2 °C, while minimum temperature is 23.7 °C.^[2] Average relative humidity is 75% ranging from 67 to 86%.^[3] This climatic condition of Mumbai favours breeding of *Aedes aegypti* mosquito, the vector for Dengue virus.

The hospital under study has a sub-district surveillance unit (SDSU) for infectious disease under Integrated disease surveillance Project (IDSP). In 2014, SDSU of the hospital has reported 128,187 & 177 cases of dengue fever in the months of September, October and November. Along with these number of cases, death of a resident doctor living in the campus was reported in spite of dengue control measures going in full swing in the city and in the hospital during this time. Hence, this project of outbreak investigation was initiated on instructions by the then Dean of the institute, with **Objectives** of environmental mapping and identify the source and reservoir of infection, to achieve inter-sectoral coordination to ensure the same and to give recommendations so as to contain the outbreak.

Methods:

Cross-sectional, one-time intensive active search was undertaken on campus. Public Health Department of Municipal Corporation has very efficient system of outbreak investigation and dengue control activities which were happening at the research setting as well. This project was undertaken to quickly contain the outbreak by intense search for

breeding sites missed on the campus. The research setting is 1800 bedded tertiary level teaching hospital with a complex of old and new hospital building, college building, old and new Undergraduate & Postgraduate (UG-PG) hostel buildings and a few residential quarters. Five teams were formed with two resident doctors in each team. Two teams supervised by one Assistant Professor from department of Community Medicine, all trained for vector detection. Co-operation was sought from all the clinical departments, operation theatre in-charges, intensive care unit in-charges, engineering department, security and insecticide office of public health department.

Systematic and thorough search was carried out for breeding sites in college building (four floors + terrace) and library building (three floors), old Undergraduate (UG) Boy's hostel, old Resident Medical Officer (RMO) hostel (ground floor + RMO canteen + three floors + terrace), UG-PG hostel (boys and girls wing each having 20 floors + terrace), New hospital building (13 floors), Main old hospital building, operation theatres (OT) and intensive care units (ICU). Each room was checked for all water collections which could be potential breeding site. This search was carried out over a period of three days from 5th November 2014. A detail report was prepared and submitted to authorities.

Since no human subjects were involved, Ethic Committee approval was not required. The permission for publication of this work is obtained from the Dean of the Institute.

Results:

Potential breeding sites were detected in drain below solar panel of terrace and overflow pipe of overhead water tank. Two sites near store room, three leakage sites, one from roof and two from pipes, air coolers in two rooms, bamboo plant in one room and scrap material on parapet of third floor outside the window were observed in old RMO hostel.

Scrap material outside RMO canteen, open drain behind canteen, one leakage site below a wash-basin and in canteen kitchen. Actual breeding was observed in the drain beside RMO canteen.

Potential breeding sites were found in scrap material in front of one room and bucket filled with water, left outside one room in UG-PG hostel, boys' wing. There was a leakage in sink pipe in one room. In girls' wing, similar potential breeding site was observed on two floors. Actual breeding was observed in the hiatus/overflow aperture of wash-basins on eight floors between second to eleventh floors. This was an unusual site formed due to peculiar design of the wash basin (Fig 1). The overflow hole was curved from inside providing space for water accumulation which allowed breeding of *Aedes* mosquitoes and had live larva.



Fig 1: The faulty design of wash basin

Six potential breeding sites were found in main hospital building, two near ICU below basin and in broken flush tank, two in corridors near OT and one money plant in nurse's room. One corridor had actual larva in water collection.

Old UG Boys' hostel showed no actual breeding but potential breeding sites near parking place, clothes washing area, coconut shells and plastic bottles, old used sandals and shoes left behind the hostel and water collection near water coolers, were seen.

Statistical analysis:

Total number of wash-basins surveyed in UG-PG hostels was 126. Out of these, 20 wash-basins showed actual breeding. The number of wash-basins surveyed in old hostels all combined were 56. No actual breeding was observed. Chi-square test was applied to find out statistical significance of the breeding sites.

Table 1: Distribution of mosquito larva breeding sites in hostels.

| Wash-Basins | Breeding positive | No breeding | Total | Chi-Square value | p - value |
|----------------------|-------------------|-------------|-------|------------------|-----------|
| New UG-PG Hostels | 20 | 106 | 126 | 9.986 | 0.0016 |
| Old Hostels combined | 0 | 56 | 56 | | |
| Total | 20 | 162 | 182 | | |

Above table shows Chi-square p-value. The p-value of < 0.05 shows that the number of wash-basins showing actual breeding was statistically significant.

Discussion:

Overflow aperture of wash-basin in old hostels were like one in regular basins, situated at straight side of basin, serving the purpose of preventing overflow by draining water easily in case of blockage in the main drain. There is less chance of water getting collected for long time. The overflow apertures in basins of New UG-PG hostel were situated on curved side and had a hollow inside where 10 to 15 ml of water got collected and remained accumulated there. This hollow made a site for breeding of mosquito larvae.

Hiatus/overflow apertures of all the wash-basins, having such design forming an unusual breeding site as identified in this case, were cleaned and closed immediately. Other identified potential mosquito breeding sites like plastic bottles, coconut shells etc. were removed by the investigating team then and there. Samples were collected from actual breeding sites and sent for confirmation of breeding of mosquito larva. Antilarval measures administered at the above-mentioned sites. Insecticide officer of concerned ward, Public health department was informed about these sites for further follow up.

Common breeding places in city includes tyres, coconut shells, empty tins, left out cups, fountains, bamboo plants, flower pots and plates below, overhead tanks, plastic or tarpaulin sheets over rooftops, leaking pipes, uncovered water containers, construction sites etc. These sources are usually checked and promptly removed. Health education material includes emphasis on these materials. At the same time, there should be focus on such unusual sites for breeding, as they act as hidden reservoir for larval breeding and leads to such outbreaks.

In this case, peculiar design of wash-basin in New UG-PG hostel created an unusual site which had maximum number of live larvae. This acted as a continuous source of infection for resident doctors. A large number of dengue positive patients are taking treatment on OPD as well as IPD basis in hospital. So, probability of mosquitoes carrying

the virus is high. One has to be vigilant about known as well as new potential breeding sites and take prompt action to contain them.

Many studies related to entomological surveillance during outbreak situation in India and elsewhere, have reported that *Aedes aegypti* and *Aedes albopictus* breeding was found in artificial water collections. Containers like discarded tires, plastic containers, cement cisterns, coconut shells, gardening utensils, broken glass-ware, had high container index for *Aedes* larvae.^[4-8] Permanent or temporary water bodies, unused wells, stagnant water, water in containers undisturbed for long duration creates habitat for larvae breeding.

Studies showed that peak of Dengue cases was reported in monsoon and post monsoon months as high vector density is found during this time leading to high rate of transmission.^[7,9] Few studies have shown that more dengue outbreaks occur in urban than in rural areas.^[9,10] Some other studies have shown that demographic factors like population growth, pattern of human settlement, rapid urbanization, migration, infrastructure development, international travel have contributed in the occurrence of frequent outbreaks. Environmental factors like global-warming, unpredictable rains, deforestation, water storage practices are also responsible for such outbreaks.^[9,11-15] Transmission of virus from imported cases and from asymptomatic individuals was also reported in studies.^[14,16] Studies have shown importance of improved diagnostic facilities, surveillance, removal of larval habitation and legislative methods in containment of outbreak.^[11,17]

Inter-sectoral co-ordination from multiple partners for containment of outbreak and environmental mapping which allowed to prioritise areas of attention were required in this case in addition to clinical management, search for cases, prompt diagnosis, treatment, prevention and control measures, notification and virologic studies. This particular exercise helped us to halt new cases among resident doctors.

Conclusion:

All Four serotypes of Dengue Virus (DENV 1, 2, 3 and 4) are found in India. Secondary infection or multiple infections with different serotypes can cause severe form of disease. Change in serotype in the area may lead to fresh outbreak. Also, vector for Dengue is found in abundance.

Aedes aegypti and *Aedes albopictus* both are container breeder found mainly in domestic and peri-domestic areas. They are found throughout the year more in monsoon and post monsoon. An active surveillance for potential mosquito breeding sites throughout the year is therefore required for better control and prevention of epidemics. Architectural development in rural areas like road projects and in urban areas especially in Mumbai, skyscraper construction forms potential reservoir for breeding of mosquitoes. Such sites should be looked for breeding.

Variety of interior designing of houses, modular kitchen designing, modern bathroom designs, garden inside the houses etc. may create certain unknown water collection pockets which can act as reservoir of mosquito breeding, as reported in the present study. Such manmade breeding sites are easily missed if not searched meticulously while doing entomological survey. Active involvement of civil and engineering department should be sought during survey to find out such hidden sites. Also, while doing such construction work and interior designing health related aspects should be taken care of.

A tetravalent vaccine against dengue fever provides protection against all four serotypes but it is not yet available in India. Hence, Integrated Vector Control is a mainstay of prevention. Health education about the awareness of breeding sites in general population and high-risk population has to be continued on a regular basis, mainly in pre-monsoon months. Effective community participation for outbreak containment can be sought by proper health education. In Mumbai, outreach camps are organised by Municipal Corporation every year in Monsoon for providing additional medical services to the general population and this opportunity is utilised for spreading awareness about monsoon related illnesses including awareness about vector breeding sites.

Co-ordination of other departments namely civil, engineering, and pest control and public health department helps improving quality of surveillance and containment of outbreaks. Timely reporting of cases

from health institutions helps to monitor trends of disease and to act accordingly.

Conflict of interest:

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