Investigation of Dengue Fever Cases with Associated Risk Factors at Suburbs of Peshawar in 2018

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ABSTRACT

Objective: To assess the magnitude of the dengue fever outbreak, evaluate risk factors and recommend control measures.
Study Design: Case-control study.
Place and Study of Study: Suburb area of Peshawar Pakistan, from May to Jun 2018.
Methodology: A desk review of available records and active case findings was conducted. A case was defined as a fever of >38 0C for 2 to 10 days with minimum two of the following; headache, rash, retro-orbital pain, myalgia and bleeding in a resident of suburb area of Peshawar and a positive NS-1 test. Age and sex-matched controls were identified from the same locality. A structured questionnaire was used to collect information about cases and controls.
Results: A total of 140 cases were identified (28 cases through active case finding). Males were 124 (88%) while females were 16 (12%). The total number of residents in that area was around 4500, the attack rate was 3.1%. The most affected age-group was 21-30 years (AR=5.03%). Out of 140 cases, 88 had open water containers in the house (OR=3.9, 95%CI=2.5-6.0), and 84 cases had larvae present in their households (OR=2.5, 95%CI=1.6-3.8). Regular use of repellents and screened doors and windows showed a protective effect.
Conclusion: The presence of open water containers inside the house served as breeding grounds for the vector and was the most probable cause of the outbreak. Regular use of repellents was shown to be protective.

Keywords: Dengue fever, Outbreak, Repellent use, water containers.

How to Cite This Article: *Minallah A, Azam N, Mansoor E, Akram F, Niazi S, Baig MA. Investigation of Dengue Fever Cases with Associated Risk Factors at Suburbs of Peshawar in 2018. Pak Armed Forces Med J 2022; 72(Suppl-2): S337-340.*

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INTRODUCTION

Dengue is a vector-borne viral disease caused by Aedes. Dengue fever (DF) is caused by one of the four serotypes of dengue virus (DEN-1, DEN-2, DEN3, DEN-4.[1] It is primarily present in tropical and sub-tropical countries, urban and semi-urban areas.[2] The incidence of dengue has increased by 30-folds over the last five decades.[3] Around 50-100 million infections are now estimated to occur annually in over 100 endemic countries with 22000 deaths, putting almost 50% of the world's population at risk.[4,5] It is most prevalent in African and Asian regions. Its incidence has dramatically increased in Pakistan over the last decade. Pakistan has gone through the journey from a disease-free to a Hyperendemic nation. The first case of dengue fever was seen in Karachi in 1994.[6] The first significant outbreak was reported in Karachi and surroundings in 2006, taking around 60 lives. It never stopped from 2011 in Lahore to 2017 in Peshawar.[7] Common causes of this rapid spread include urbanization, overcrowding, lack of awareness and failure to adopt preventive measures.[8,9]

In May 2018, dengue fever cases again started rising in Peshawar, and 112 cases were reported from a suburban area. This study was done to assess the magnitude of the outbreak, identify risk factors and take control measures for future prevention. Dengue fever has become endemic in Pakistan. Many studies have been carried out to identify risk factors and implement preventive measures. This study aims to find out the grey areas that led to this outbreak and implement such measures to avoid its recurrence.

METHODOLOGY

This case-control study was performed from May to June 2018 in a suburb area of Peshawar Pakistan. Institutional Ethical Review Board permission was sought and granted before starting the study.

Inclusion Criteria: A case was defined as any person residing in the suburb area of Peshawar and presenting with fever of >38 0C with at least two of the manifestations which include: headache, rash, retro-orbital pain, myalgia, bleeding from May to June 2018 and a positive NS1 antigen test. Age, sex and socio-economic condition matched controls were selected from the same locality.

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Received: 01 Aug 2018; revision received: 20 Jun 2020; accepted: 29 Jun 2020

Exclusion Criteria: Individuals with any neurological disorder or not willing to participate in the study were excluded.

The local area hospital records and surveillance data were reviewed, and an active case finding via house to house survey was carried out to identify other cases (n=140). Hospital-based consecutive sampling was done for cases. Age, sex and socio-economic condition matched controls were selected from the same locality. Interviews using a structured and validated questionnaire were done for data collection, which included different variables like open water containers inside the house, presence of Aedes larva inside the house/compound, presence of desert coolers and discarded tires inside the house, screened doors and windows, families using repellents etc. As entomologists were also present, environmental surveillance for larva was also carried out. After reviewing hospital records and active case searches, a line list was maintained to get systematic information about each person under investigation. Initially, a descriptive analysis was done, and the out break was described in terms of time, place and person, followed by age and sex-matched case-control study in which cases and controls were selected at 1:2. Around 280 controls were identified, making a total sample size of 420. All the persons were included as cases which fall under the operational case definition, while controls were selected based on age, sex and socio-economic status from the same locality by obtaining the list of individuals living in the locality.

Statistical Package for Social sciences (SPSS) version 120 was used for data entry and statistical analysis. Frequencies and percentages were calculated for each variable, and attack rates were determined. Analysis of different exposure variables in cases and controls and odds ratios were calculated using a 2x2 table for individual exposure variables. The chi-square test was used at a 95% confidence interval (CI) with the *p*-value of ≤0.05 considered statistically significant.

RESULTS

The total number of cases identified was 140 (28 were found through an active case search). The median age was 29 years, with the range of 8-55 years (IQR: 31 years). Males were more affected than females [124 (88%) males vs. 16 (12%) females]. The population of that small area (population at risk) was around 4500 individuals and the attack rate was 3.1%.

The time distribution of the cases has also been calculated by the date of onset of symptoms which shows the Epi curve. The time distribution of the cases by date of onset of symptoms was shown in the Figure.

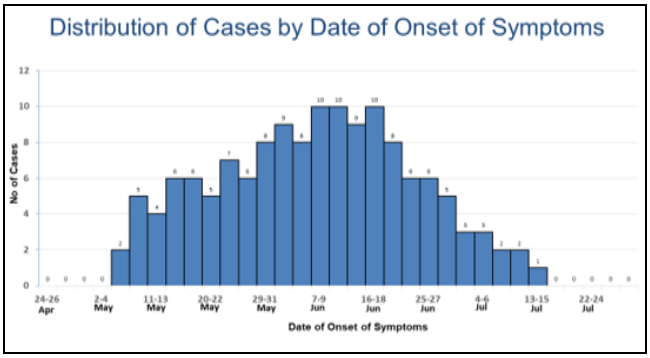

Figure: Epi curve showing time distribution of cases.

Age-specific attack rate was calculated for each age group which showed the most affected age group of 21-30 years with an attack rate of 5.03%. It was shown in Table-I.

Table-I: Age Specific Attack Rates of Dengue Fever Cases (n=140).

Age group (years)	Cases (n=140)	Population	Attack Rates
1-10	3%	324	1.29%
11-20	8.5%	531	2.2%
21-30	57%	1584	5.03%
31-40	17%	1170	2.03%
41-50	8.5%	606	1.96%
> 50	5.7%	285	2.8%
Total	100%	4500	Overall AR= 3.1%

Table-II: Exposure variables with odds ratios and 95% confidence interval.

Exposure variables	Cases (n=140)	Controls (n=280)	Odds Ratio	95% CI
Open Water Containers Inside House	63%	30%	3.9	2.5 - 6.0
Aedes Larva Inside House/Compound	60%	37%	2.5	1.6 - 3.8
Desert Coolers	63%	41%	2.3	1.5 - 3.6
Tires in House/ Compound	26%	17%	1.6	1.2 - 2.7
Screened Doors and Windows	26%	49%	0.36	0.2 - 0.5
Families Using Repellents	31%	60%	0.3	0.2 - 0.5

The most common symptoms were fever (140, 100%), myalgia (123, 88%) and headache (108, 77%). Other symptoms included rash, vomiting and bleeding. Lab showed NS1 positive cases (119, 85%), PCR positive (7 , 5%) and IgM positive cases (11 , 8%). Out of 140 cases, 88 (63%) had open water containers in the house with an odds ratio of 3.9 and confidence interval

of 2.5-6.0, and 84 (60%) cases had larva in their house with an odds ratio of 2.5 and confidence interval of 1.6-3.8. The *p*-value of the above-mentioned variables came out to be significant (<0.05).

Screened doors and windows and the use of repellents showed a protective effect on dengue infection. Complete risk factor analysis was shown in the Table-II.

DISCUSSION

Dengue has emerged as a rapidly spreading arthropod-borne disease. The World Health Organization has declared it a significant public health concern disease.[10] This study was conducted in Peshawar to highlight the magnitude and assess the risk factors involved with dengue infection. It showed that most cases of dengue infection have fever and myalgia while few have hemorrhagic tendency. Males were more affected than females, which can be seen in other studies, which might be due to more outdoor exposure and wearing half sleeves shirts. However, gender differences were found to be insignificant in fewer studies.[11] Median age was 29 years with the range of 8-55 years. A study conducted in Saudi Arabia showed an almost similar result with ages ranging from 16-60 years.[12] Another study conducted in Lahore showed a range from 15-50 years.[7]

In our study, the most affected age group was 21-30 years, which shows similar results to a study conducted in Karachi.[8] Overall attack rate in our study is 3.1%, while other similar studies have varying attack rates ranging from 2-9%.[13] Presence of open water containers and larva showed significant association in acquiring dengue infection. Another study conducted in Lahore showed a similar risk factor analysis.[7] Different studies conducted worldwide have shown numerous risk factors associated with Dengue infection.[13,14] A study conducted in Vietnam showed a significant association between dengue infection with the presence of larva in water containers and the presence of a garden near the house.[15] Our study also showed a strong association with the presence of desert coolers in the house, as the water inside the desert coolers showed breeding grounds for the vector. A case-control study in Singapore found co-morbidity like Hypertension as a strong factor in acquiring dengue infection.[16] In contrast, our study did not show any such association. In our study, screened doors and windows and repellents were having a protective effect on dengue infection, which is in line with few other national and international studies.[17-19]

Besides finding various risk factors, few public health measures were also carried out, which we believe was deficient in a few other studies. Health education sessions were carried out in that area, emphasizing preventive aspects. Another important thing that was missing in previous studies is implementing an integrated vector control program with the help of the local health department. Another issue which was missing in the literature is the follow-up. Our team has constant contact with the local health authorities and ensures the timely implementation of preventive measures to prevent the recurrence of the disease.

Disease outbreaks can be devastating for the health and the economy, but systematic investigation and institution of timely preventive and control measures can save many lives and precious resources that are already limited. As dengue has become a reality and endemic in Pakistan, standard steps need to be taken not only proactively but also preemptively to avoid such outbreaks in the future.

LIMITATIONS OF STUDY

Due to the cultural norms of the area, we faced refusals and little difficulty in getting into the houses for the survey. The language was also a barrier, but it was overcome as we had local people.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the help and assistance of Dr Rana Jawad Asghar, Resident Advisor Field Epidemiology and Lab Training Program (FELTP) Pakistan and FELTP Disease Surveillance and Response Unit KPK in conducting the study.

CONCLUSION

The presence of open water containers, desert coolers and discarded tires inside the house provided the breeding ground for the vector and most probably helped spread the disease, while screened doors and windows and mosquito repellents had a protective effect.

Conflict of Interest: None.

Authors' Contribution

AM: Substational, NA:, MAB: Intellectual, EM: Interpretation, FA: Data analysis, SN: Experimental analysis.

REFERENCES

1. Ahmed H, Ali S, Afzal MS, Khan AA, Raza H, Shah ZH, et al. Why more research needs to be done on echinococcosis in Pakistan. Infect Dis Poverty 2017; 6(1): 90.
2. Munir MA, Alam SE, Khan ZU, Saeed Q, Arif A, Iqbal R, et al. Dengue fever in patients admitted in tertiary care hospitals in Pakistan. J Pak Med Assoc 2014; 64(5): 553-559.
3. Saqib MA, Rafique I, Bashir S, Salam AA. A retrospective analysis of dengue fever case management and frequency of comorbidities associated with deaths. BMC Res Notes 2014; 7(1): 205.

4. Ali A, Ahmad H, Idrees M, Zahir F, Ali I. Circulating serotypes of dengue virus and their incursion into non-endemic areas of Pakistan; a serious threat. Virol J 2016; 13(1): 144.
5. Humphrey JM, Cleton NB, Reusken CBEM, Glesby MJ, Koopmans MPG, Abu-Raddad LJ (2016) Dengue in the Middle East and North Africa: A Systematic Review. PLoS Negl Trop Dis 2016; 10(12): e0005194.
6. Mukhtar F, Salim M. Outbreak of dengue fever in Lahore: study of risk factors. J Ayub Med Coll Abbottabad 2012; 24(2): 99-101.
7. Ahmed A, Alvi AH, Butt A, Nawaz AA. Assessment of Dengue fever severity through liver function tests. J Coll Physicians Surg Pak 2014; 24(9): 640-644.
8. Khalid B, Ghaffar A. Environmental risk factors and hotspot analysis of dengue distribution in Pakistan. Int J Biometeorol 2015; 59(11): 1721-1746.
9. Bashir S, Salam AA. A retrospective analysis of dengue fever case management and frequency of co-morbidities associated with deaths. BMC Res Notes 2015; 7(1): 205.
10. World Health Organization. Dengue guidelines for diagnosis, treatment, prevention and control. World Health Organization, new edition: 2009 [Internet] Available at: https://pubmed.ncbi.nlm.nih.-gov/23762963/
11. Khormi HM. Modelling dengue fever risk based on socioeconomic parameters, nationality and age groups: GIS remote sensing based case study. Sci Total Environ 2011; 409(22): 4713–4719.
12. Braga C, Luna CF, Martelli CM, De Souza WV, Cordeiro MT. Seroprevalence and risk factors for dengue infection in socioeconomically distinct areas of Recife, Brazil. Acta Trop 2010; 113(3): 234–240.
13. Phoung HL, De Vries PJ, Bhooshuyar C, Binh TQ, Nam NV, Kager PA. Dengue risk factors and community participation in BinhThuan Province, Vietnam, a household survey. Southeast Asian J Trop Med Public Health 2008; 39(1): 79–89.
14. Ashford DA, Savage HM, Hajjeh RA, Mcready J, Bartholomew DM, Spiegel RA, et al. Outbreak of dengue fever in Palau, western Pacific: risk factors for infection. Am J Trop Med Hyg 2003: 69(2): 135–140.
15. Figueiredo MA, Rodrigues LC, Barreto ML, Lima JW, Costa MC, Morato V, et al. Allergies and diabetes as risk factors for dengue hemorrhagic fever: results of a case control study. PLoS Negl Trop Dis 2015; 4(6): e699.
16. Pang J, Salim A, Lee VJ, Hibberd ML, Chia KS, Leo YS, et al. Diabetes with hypertension as risk factors for adult dengue hemorrhagic fever in a predominantly dengue serotype 2 epidemic: a case control study. PLoS Negl Trop Dis 2014; 6(5): e1641.
17. Montenegro D, Lacerda HR, Lira TM, Oliveira DS. Clinical and epidemiological aspects of the dengue epidemic in Recife. [Article in Portuguese]. Rev Soc Bras Med Trop 2016; 39(1): 9–13.
18. Schmidt W-P, Suzuki M, Dinh Thiem V, White RG, Tsuzuki A, Yoshida L-M, et al. Population Density, Water Supply, and the Risk of Dengue Fever in Vietnam: Cohort Study and Spatial Analysis. PLoS Med 2011; 8(8): e1001082.
19. Lloyd LS. Environmental health project: Best practices for dengue prevention and control in the Americas. Strategic report 7.Washington DC: Organizacion Panamericana de la salud; 2003, Available at: https://pubmed.ncbi.nlm.nih.gov/17439693/

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