International Journal of Research in Medical Sciences
Dhanya PR et al. Int J Res Med Sci. 2018 Jun;6(6):2111-2115
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20182298

Original Research Article

A comparative study on dengue and malaria infections and analysis on the prevalence of co-infection from a rural tertiary care hospital

Dhanya P. R., Shilpa K., Vivek Hittinahalli*

Department of Microbiology, East Point College Medical Sciences and Research Centre, Avalahalli, Bangalore, Karnataka, India

Received: 09 April 2018
Accepted: 01 May 2018

***Correspondence:**
Dr. Vivek Hittinahalli,
E-mail: drvivekhittinahalli@gmail.com

ABSTRACT

Background: To compare dengue fever and malaria infection cases from a rural tertiary care hospital.
Methods: Samples from January 2017 to February 2018 which had come to the Department of Microbiology at East Point College of Medical Science and Research Centre were included in the study. Serological diagnosis of dengue was done using the rapid dengue day 1 test which detects NS1, IgM and IgG. This test can be performed using serum, plasma or whole blood. Malarial parasites were identified by peripheral smear for malaria by Leishman's stain and Jaswant Singh Battacharji (JSB) stain, rapid tests were performed by using advantage mal card, which detects plasmodium falciparum and plasmodium vivax by using human whole blood.
Results: Monthly analysis is done for dengue samples and malaria samples were done during January 2017 to February 2018. Positive samples are then analysed according to NS1 positive cases, IgM positive cases, IgG positive cases, NS1 and IgM combined cases, NS1 and IgG combined cases and IgM and IgG combined cases for dengue. In case of malaria vivax and falciparum cases were compared. Samples are then compared among different age groups. Under 15 age- group there were 32 positive cases of NS1, 1 case of IgM and IgG combined positive and 1 case of P. falciparum infection. In 16-50 age-group 244 cases were dengue NS1 positive, 1 case positive for NS1 and IgM combined, 1 case for NS1 and IgG combined, 5 cases for IgM and IgG combined, 11 cases of P. vivax and 3 cases of P. falciparum. Above 50 age-group had 27 NS1 positive cases and 1 case of IgM and IgG combined. NS1 and Plasmodium vivax species positives were more from dengue and malaria infection.
Conclusions: From July 2017 to October 2017 dengue and malaria cases were drastically increased. Malariacases drops from November to December 2017 and again raised from January to February 2018, which shows seasonal variations. So, we conclude that viral and parasitic infection mainly occurs in July to September months and has to be ruled by proper clinical diagnosis.

Keywords: Co-infection, Dengue NS1, IgM and IgG, *Plasmodium falciparum, plasmodium vivax*

INTRODUCTION

Mosquito is considered to be an important animal vector that can cause several diseases to human beings. Mosquito borne infectious disease is accepted as important tropical infections and is the focused topic in tropical medicine. There are several tropical mosquito borne infections. Malaria and dengue are the two common mosquito infections that are very important and cause high morbidity and mortality for many patients around the world[1]. Dengue fever and malaria are the most common arthropod-borne diseases in humans and represent major public health problems. Dengue virus (family *Flaviridae*, genus *Flavivirus*) and *Plasmodium* parasites are widespread in American and Asian tropical regions and their endemic areas overlap extensively.[2] The dengue virus (DENV) is the major arbovirus responsible for human disease in Brazil. The four serotypes cause a

variety of clinical presentation in humans, ranging from acute self-limited febrile illness to severe and fatal forms. Regarding malaria the Brazilian Amazon reports 50% of episodes in the Americas. In 2012, 241,806 cases were reported, with 86.9% of them due to P. vivax. Malaria and dengue are endemic in similar tropical regions, and therefore, may result in the possibility of co-infection. Urban demographic expansion, deforestation and agricultural settlements in peri-urban areas, are known causes of the increase in the probability of concurrent infection of these two diseases.

METHODS

The present study was conducted on January 2017 to February 2018 at East Point College Medical Sciences and Research Centre, Avalahalli, Bengaluru: a rural tertiary care hospital, to compare the sero-prevalence, seasonal variation of outbreaks and the incidence of viral and parasitic fever in seropositive dengue and malaria patients. Samples were obtained from 1355 suspected cases of dengue and 494 cases of malaria infections. Serological diagnosis was done using the rapid Dengue Day 1 Test which detects NS, IgM and IgG, the test can be performed using serum, plasma or whole blood.

Malarial parasites were identified by peripheral smear for malaria by Leishman's stain and Jaswant Singh Battacharji (JSB) stain. Rapid tests were performed by using Advantage Mal card, which detects plasmodium falciparum and plasmodium vivax by using human whole blood. The diagnosis of malaria was established on thick and thin blood film microscopy.

RESULTS

Samples from January 2017 to February 2018 which had come to the Department of Microbiology at East Point College of Medical Science and Research Centre were included in the study. Monthly analysis is done for dengue samples and malaria samples received during this period (Table 1). A total of 1366 samples had received for dengue and 494 for malaria. In the month of January 2017, 22 (1.61%) dengue samples were received but no samples for malaria. In the month of February 2017, 12 (0.87%) dengue and 5 (1.01%) of malaria samples came to the lab. In the month of March 2017, 32 (2.34%) dengue and 10 (2.02%) malaria samples received. In April 2017 dengue samples received were 12 (0.87%) and malaria were 5 (1.01%). In May 2017 dengue samples received were 30 (2.19%) and malaria were 16 (3.23%). 59 (4.31%) dengue samples and 32 (6.47%) malaria samples were received in the month of June 2017. 174 (12.73%) dengue samples and 54 (10.93%) malaria samples were received in July 2017. In August 2017, 230 (16.83%) dengue samples and 50 (10.12%) of malaria samples came. September month showed 235 (17.20%) dengue samples and 59 (11.94%) malaria samples. 235 (17.20%) dengue samples and 39 (7.89%) malaria samples received in October 2017. In November 2017 it was 156 (11.42%) dengue samples and 44 (8.90%) malaria samples. In December 2017 there were 86 (6.29%) dengue and 22 (4.45%) malaria samples. 45 (3.29%) dengue and 70 (14.17%) malaria samples were received in January 2018. And finally in February 2018 48 (3.51%) dengue and 88 (17.81%) malaria samples were received.

Table 1: Monthly samples of dengue and malaria from January 2017 to February 2018.

Month	Dengue	Malaria
Jan-17	22	0
Feb-17	12	5
Mar-17	32	10
Apr-17	12	5
May-17	30	16
Jun-17	59	32
Jul-17	174	54
Aug-17	230	50
Sep-17	292	59
Oct-17	235	39
Nov-17	156	44
Dec-17	86	22
Jan-18	45	70
Feb-18	48	88
Total	1366	494

Table 2: Age-wise distribution of dengue, malaria and co-infection cases.

Age	Dengue						Malaria		Co-infection
	NS1	IgG	IgM	NS1 IgG	NS1 IgM	IgG IgM	*Plasmodium vivax*	*Plasmodium falciarum*	
<=15	32	0	0	0	0	1	0	1	2
16-50	244	0	0	1	1	5	11	3	3
>50	27	0	0	0	0	1	0	0	0
Total	303	0	0	1	1	7	11	4	5

Positive samples are then analysed according to NS1 positive cases, IgM positive cases, IgG positive cases, NS1 and IgM combined cases, NS1 and IgG combined cases and IgM and IgG combined cases for dengue. In case of malaria vivax and falciparum cases were compared. Samples are then compared among different age groups. (Table 2). Under 15 age- group there were 32 positive cases of NS1, 1 case of IgM and IgG combined

positive and 1 case of P. falciparum infection. In 16-50 age group 244 cases were dengue NS1 positive, 1 case positive for NS1 and IgM combined, 1 case for NS1 and IgG combined, 5 cases for IgM and IgG combined, 11 cases of P. vivax and 3 cases of P. falciparum. Above 50 age-group had 27 NS1 positive cases and 1 case of IgM and IgG combined. Sex-wise analysis of dengue and malaria infection shows a total 295 NS1 positive cases in which 203 were males and 100 were females. There were no cases of either IgG or IgM positives. One sample (female) was positive for NS1 and IgG combined and one (female) for NS1 and IgM combined case. For IgG and IgM combined cases 3 male samples and 4 female samples were positive which shows a total of 7 positive cases. Plamodium vivax positive cases were 11 in which 8 were males and 3 were females. 4 cases of P. falciparum were received in which 3 were males and 1 was female. (Table 3).

Table 3: Sex-wise distribution of dengue and malaria infections.

Sex	Dengue						Malaria		Co-infection
	NS1	IgG	IgM	NS1 IgG	NS1 IgM	IgG IgM	*Plasmodium vivax*	*Plasmodium falciparum*	
Male	203	0	0	0	0	3	8	3	4
Female	100	0	0	1	1	4	3	1	1
Total	303	0	0	1	1	7	11	4	5

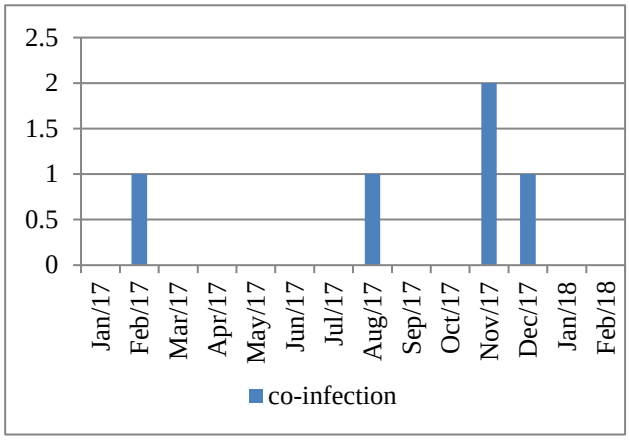

Figure 1: Seasonal distribution of co-infection.

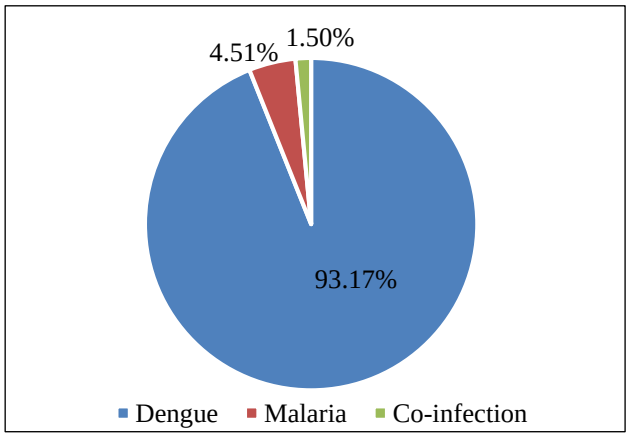

Figure 2: Percentage wise distribution of positive cases.

Analysis of the data based on the prevalence of co-infection of dengue and malaria showed that 5 samples were positive for both dengue and malaria infection (Figure 1 and 2). Out of 332 positive samples 5 (1.5%) were positive for both dengue and malaria. One case came in the month of February 2017, one in August 2017, 2 in October 2017 and one in December 2017.

DISCUSSION

The study was a comparative analysis of dengue and malaria cases from rural tertiary care centre. We found out prominent seasonal variation of the cases while analysing the data. According to our study the cases start rising during the beginning of monsoon (July), hikes and reaches its peak during September and ceases along with the season (November). This is because of spread of mosquitoes during monsoon.

Overall, increased incidence rates were observed between July and December during the study period. Our findings provide insight into understanding the seasonal pattern and associated climate risk factors in each province. This study may be another way of providing evidence to aid clinicians when making a diagnosis and foresee the timing of outbreaks, therefore may be utilized to raise public awareness during the high peak seasons in order to prevent or reduce further potential outbreaks or onwards transmission during an outbreak.[4]

Age-wise analysis of positive cases revealed that both dengue and malaria infection were the most among 16-50 age group. Hence according to our studies middle-aged group in our area are more prone to these infections. We also analysed the data sex-wise and found out that positive cases were more in males than females. Similar study by Smita T et al, also showed higher percentage of male cases than females with a ratio of 1.55:1.[5] Co-infection cases were analysed separately and it showed that only 1.5% of the total cases were positive for dengue and malaria co-infection. Even though there is no clear pattern in the monthly distribution of co-infection cases, out of 5 total cases 3 were during the time of monsoon. This could be because of increased number of cases during this time.

Due to similar clinical presentations of malaria and dengue, these co-infections may give rise to an incorrect diagnosis. Moreover, the treatment regimens for these co-infections are not the same as those for mono-infections. Hence, a delay in implementing the appropriate treatment regimen for these concurrent infections due to poor diagnosis can be fatal.[6]

Dengue is one of the re-emerging viral infections. India is now being affected with several outbreaks every year, increase in the number of cases reported and also showing an increase in the severity of the disease. As there is no specific drug available and since the vaccine is still in the developmental stage, treatment is still only supportive, therefore the control measures should be aimed at the vector control. There is an urgent need to strengthen national programmes for preventing Dengue and DHF. This will also help us to control other mosquito borne diseases like malaria, chikungunya, Japanese encephalitis and filaria in India. The laboratory surveillance also has to be enhanced in different parts of the country for prompt and early diagnosis. The state should pave the way for evolving effective vector control strategies both in rural and urban areas to curb this growing disease.[7]

Dengue and malaria infections share similar symptomatology include (a) high fever, (b) headache, (c) retro-orbital pain, (d) nausea/vomiting, (e) myalgia (muscle pain), (f) generalized skin rashes, (g) arthralgia, (h) diarrhea, (i) fatigue, (j) pleural effusion, (k) hypotension, (l) ascites, (m) gastrointestinal bleeding in critical phase, (n) itching, (o) slow heart rate, (p) seizures and (q) altered level of consciousness. In the case of dengue haemorrhagic fever the history of illness was revealed by the sudden rise of fever (38.3-39.4°C), headache, retro-orbital pain, conjunctival congestion, and facial flushing with fever sustaining for 2-15 days. Additionally, some cases had a history of hemorrhagic manifestation, either with petechiae, gum bleeding, hematuria or melena.[8]

Our study highlights the importance of testing for malaria in patients suspected of having dengue infection in malaria endemic settings. The two infections are clinically indistinguishable and specific diagnostic testing is needed to confirm the diagnosis. The confirmation of one infection should not preclude the possibility of co-infection. Further well-designed prospective studies are needed to understand the effect of co-infection on the severity of the disease.[9]

As the prevention of dengue fever lacks proper vaccine, the main preventive strategy is the awareness building in the community regarding the source reduction process by emptying the man made containers or dispose those in a systematic or in a proper way. Much efforts to be taken to promote the participation of the community in the action program for eliminating vector-breeding sites.[10]

CONCLUSION

Seasonal variations in the infection cases are clearly observed and found out to be more during monsoon season with an increased incidence among middle-aged group. Males were infected more than females in the study. Even though rate is very less, the chances of getting dengue and malaria co-infection cannot be neglected and proper laboratory diagnosis is required to differentiate between dengue mono-infection, malaria mono-infection and co-infection cases for effective treatment.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Dhanya PR, Shilpa K, Hittinahalli V. A comparative study on dengue and malaria infections and analysis on the prevalence of co-infection from a rural tertiary care hospital. Int J Res Med Sci 2018;6:2111-5.