An Observational Study on Effect of Dengue Fever on Liver Function in Patients Admitted to a Tertiary Care Centre in Rural South Kerala

Authors
Dr H Poornima¹, Dr Giri Vishnu²

¹Additional Professor, Department of Medicine, Government TD Medical College, Alappuzha
²Senior Resident (Former), Department of Medicine, Government TD Medical College, Alappuzha
Consultant Physician, Sagara Hospital, Alappuzha

Corresponding Author
Dr Giri Vishnu G
Vishnugiri (H), Peroor PO, Kottayam, Kerala State, Pin 686637, India

Background
Dengue is an important mosquito borne disease in the tropical and subtropical countries. It is often self limited and presents with arthralgia, myalgia, head ache and fever. Though not a hepatotropic virus, liver injury is not uncommon in dengue infection¹. The degree of liver dysfunction varies from mild to severe.²,³ The exact mechanism of the liver dysfunction is not known, but is postulated to be either a direct effect of the virus or a dysregulated host immune response².

The present study aims at finding the effects of dengue virus on the liver function and its effect on the severity and outcome of the disease in patients admitted in a tertiary care centre in south Kerala.

Aims and Objectives
A. To study the pattern of liver function abnormalities in patients admitted with dengue.
B. To study the effects of liver function abnormality on the severity and the outcome of dengue.

Materials and Methods
Study Population
Patients admitted with the diagnosis of Dengue fever from the June – December 2018 in a tertiary care centre in rural south Kerala.

Study Design: Observational study

Inclusion Criteria
a. Age more than or equal to 13 years of both the sexes.
b. Patients satisfying the WHO definition for Dengue.

Exclusion Criteria
a. Those who are not willing to give consent.
b. Those with known pre existing chronic liver disease or acute hepatitis of other etiology.

Methods
Among the patients presenting to the outpatient department or emergency department of the institution who satisfied the inclusion criteria were enrolled in the study.
After history taking and physical examination the following investigations will be performed.
1. Blood Samples for: Complete Blood Counts, Erythrocyte Sedimentation Rate, Blood Urea, Serum Creatinine
2. Daily Liver function tests
3. Ultrasound abdomen in relevant cases.

The patients will be hospitalized according to the institutional protocol and managed as per the WHO guidelines. Patients will be monitored clinically for the development of Dengue Shock Syndrome/ Dengue Hemorrhagic Fever. Daily CBC will be measured for the evidence of hemoconcentration.

Liver function abnormalities were classified as mild (up to two fold elevation of liver enzymes- ALP, ALT and AST), Moderate (3-4 fold elevation} and severe(> 5 fold). The serum bilirubin and the albumin levels were also observed. The INR value of prothrombin time were also measured.

The hospital course, the development of complications and its relationship with liver function abnormality were studied. The final outcome was measured as died or survived.

**Definitions**

WHO 2009 definitions of Dengue fever

1. Probable Dengue fever
An acute febrile illness with 2 or more of the following:
- Retro orbital pain
- Myalgia and arthralgia
- Nausea and vomiting a
- Skin rash
- Hemorrhagic manifestations.

AND
Supportive serology OR
Occurrence at the same location and time as other confirmed cases of Dengue fever

2. Confirmed case of Dengue fever: Confirmation of Dengue fever is baed on laboratory criteria
   Isolation of virus from serum or tissue sample OR
   Demonstartion of 4 fold or more rise in Ig G and Ig M antibody titres to the dengue antigens in paired serum samples
   OR
   Demonstration of dengue antigens in tissue, serum, CSF by immunohistochemistry, immunoflourescence or ELISA
   OR
   Detection of genomic sequences by PCR

Dengue Hemorrhagic Fever: Requires all 4 of the following to be satisfied:

a. Acute fever lasting 2-7 days occasionally bi phasic.
b. Hemorrhagic tendencies as evidenced by atleast one of the following: a positive tourniquet test, petechiae, ecchymosis purpura, bleeding from mucosa, hematemesis or malena
c. Thrombocytopenia <100000/mm3
d. Plasma leakage as evidenced by at least one of the following: Rise in hematocrit > 20%, Fall in hematocrit >20% after IV fluids, Pleural effusion, ascites or hypoalbuminemlia.

Dengue Shock Syndrome
The identification of Dengue shock syndrome requires all 4 of the dengue hemorrhagic fever criteria and evidence of circulatory failure as manifested by:

1. Rapid and weak pulse
2. Narrow pulse pressure (< 20mm Hg)
3. Hypotension for age (<90mm Hg for age > 5 years)
4. Cold clammy skin, restlessness.

**Observations**

342 cases satisfied the inclusion criteria and were enrolled after obtaining an informed consent.
Most of the patients were in the age group of 16-60 years of age, which represents the most productive of the age groups.

31% of the cases were females and 69% were males.

Of the 342 cases, 75.4% were classified as having Dengue Fever, 23% as Dengue Hemorrhagic fever and 1.5% as Dengue Shock Syndrome, according to the WHO definitions.

88.88% were having NS1 antigen positivity, 69.8% had IgM antibody and 20.7% had IgG antibody against dengue virus. Of the patients with Dengue Shock Syndrome, 60% were positive for the IgG antibody, signifying a re infection.

Hepatic dysfunction in the form of deranged bilirubin, AST, ALT, Albumin and PT/INR were seen in 4.3 %, 97.07%, 80.7%, 6.4%, and 11.1% respectively.

The mean AST was more than the mean ALT in the patients.
Among the cases, 75.4% had Dengue fever, 23.1% had Dengue Hemorrhagic Fever and 1.5% had dengue shock syndrome. 0.9% succumbed to the illness, whereas, 99.1% survived.

Figure 3: Pattern of AST Elevation among Various Class of Dengue

There was significant association between the level of rise of aminotransferases and complications, like DHF and DSS. (p Value 0.000).
Figure 5: Pattern of Elevation of Serum Bilirubin in Various Class of Dengue

There was a significant relation between rise in serum bilirubin and occurrence of DHF and DSS. (p value 0.00)

Figure 6: Pattern of Albumin Levels in Various Class of Dengue

An association was noted between low albumin levels and occurrence of severe forms of dengue.
Figure 7: Prothrombin Time with INR Levels among Various Classes of Dengue

There was no significant association between elevated INR values and occurrence of severe forms of dengue. (p value > 0.05)

Table 1: Relationship between ALT Levels and Occurrence of Dengue Shock

| VARIABLE                      | DENGUE SHOCK SYNDROME | P VALUE |
|-------------------------------|------------------------|---------|
|                               | YES | NO |      |
| ALANINE AMINO TRANSFERRASE LEVELS |NORMAL | 0 | 66 | 0.270 |
|                               | ELEVATED | 5 | 271 |     |

Table 2: Relationship between AST Levels and Occurrence of Dengue Shock

| VARIABLE                      | DENGUE SHOCK SYNDROME | P VALUE |
|-------------------------------|------------------------|---------|
|                               | YES | NO |      |
| ASPARTATE AMINO TRANSFERRASE LEVELS |NORMAL | 0 | 10 | 0.000 |
|                               | ELEVATED | 5 | 327 |     |

Table 3: Relationship of Bilirubin Levels and Occurrence of Dengue Shock

| VARIABLE                      | DENGUE SHOCK SYNDROME | P VALUE |
|-------------------------------|------------------------|---------|
|                               | YES | NO |      |
| BILIRUBIN LEVELS              |<2 MG% | 0 | 327 | 0.000 |
|                               |>2 MG% | 5 | 10 |     |

Table 4: Relation between Serum Albumin Levels and Occurrence of Dengue Shock

| VARIABLE                      | DENGUE SHOCK SYNDROME | P VALUE |
|-------------------------------|------------------------|---------|
|                               | YES | NO |      |
| ALBUMIN LEVELS                |<3.5 MG% | 0 | 17 | 0.000 |
|                               |>3.5 MG% | 5 | 320 |     |
Table 5: Relationship between Prothrombin Times INR with Occurrence of Dengue Shock

| VARIABLE                | DENGUE SHOCK SYNDROME | P VALUE |
|-------------------------|------------------------|---------|
|                         | YES | NO  |       |
| PROTHROMBIN TIME INR LEVELS | <1.5 | 0   | 304  | 1.87 |
|                         | >1.5 | 5   | 33   |      |

Table 6: Relationship of Various Variables to the in Hospital Outcome

| VARIABLE                | IN HOSPITAL OUTCOME | P VALUE |
|-------------------------|---------------------|---------|
|                         | DIED  | SURVIVED |       |
| ALANINE AMINO TRANSFERASE | NORMAL | 0 | 66 | 0.300 |
|                         | ELEVATED | 3 | 273 |      |
| ASPARTATE AMINOTRANSFERASE | NORMAL | 0 | 10 | 0.76 |
|                         | ELEVATED | 3 | 329 |      |
| SERUM BILIRUBIN <2MG%    | 1     | 326 | 1.12 |
|                         | >2MG%  | 2  | 13  |      |
| SERUM ALBUMIN <3.5MG%    | 3     | 19  | 3.2 |
|                         | >3.5MG% | 0 | 320 |      |
| PROTHROMBIN TIME INR LEVELS | <1.5 | 0 | 304 | 1.87 |
|                         | >1.5  | 5  | 33  |      |

There was no significant relation between the occurrence of bleeding manifestation to the level of aminotransferases, albumin, bilirubin or INR levels.

Discussion

The clinical and biochemical impact of dengue virus on the liver function during an outbreak in south kerala was studied. Total 342 cases were included in this study. The occurrence of abnormal liver function test in the form of abnormal AST (97.07%) and ALT (80.07%) seen in our study was comparable to previous studies.\(^4,5,6\)

Rise in bilirubin was seen only in a small proportion.\(^6\)

The aspartate aminotransferase levels in dengue tends to be greater than alanine amino transferase. This differs from the usual pattern of viral hepatitis. The exact cause of this is not known but is thought to be due to the release of AST from monocytes. This can be used as an indicator of Dengue infection at the early stages itself.\(^7,8,9\)

In our study, the degree of liver dysfunction had a correlation with the severity of dengue infection. This is in accordance with the observations made in a previous study.\(^9\)

A high serum bilirubin and a low serum albumin had an association with the occurrence of shock in dengue, in our study.

Our study failed to identify a positive correlation between the various liver function parameters and the occurrence of bleeding.\(^10,11\)

Our study failed to identify any correlation between mortality and liver function abnormality, though liver dysfunction was more in non survivors than survivors.

This study thus throws light into the fact that liver function can be used as a predictor of development of severe forms of dengue, though mortality in dengue may not be realted to the liver function abnormalities alone.

References

1. Burke T. Dengue Hemorrhagic fever: A pathological study. Trans R Soc Trop Med Hyg. 1968; 62(5): 682-692
2. Seneviratne SL, Malavige GN, deSilva HJ. Pathogenesis of liver involvement during dengue viral infections. Trans R Soc Trop Med Hyg. 2006;100(8): 608-614.
3. Lum LC, Lam SK, George R, Devi S. fulminant hepatitis in dengue infection. South east asian J Trop Med Public Health. 1993; 24(3): 467-471.
4. Sharma S, Sharma SK. Clinical profile of DHF in adults during 1996 outbreak in Delhi, India. Dengue Bulletin. 1998;22:20-27.

5. Daniel R, Rajamohanan, Philip AZ. A study of clinical profile of dengue fever in kollam, Kerala, India. Dengue Bulletin. 2005; 29:197-202.

6. Itha S, Kashyap R, Krishnani N, Saraswat VA, Choudari G, Aggarwal R. profile of liver involvement in dengue virus infection. Natl Med J India. 2005; 18(3): 127-130.

7. Kuo Ch, Tai DI, Chang Chein CS, Lan CK, Chiou SS, Liaw YF. Liver biochemical tests and dengue fever. Am J trop Med Hyg. 1992; 47(3): 265-270.

8. Souza LJ, Goncalves, Carnero H, Souto Filho JT, Souza TF, Cortes VA, Neto CG, Bastos DA, Siqueira EWS. Hepatitis in dengue shock syndrome. Braz J Infect Dis. 2002;6(6): 322-327.

9. Kalayanarooj S, Vaughn DW, Nimmanitya S, Green S, Suntayaorn S, Kunentrassai N, Viramitrachai W, Ratanchueke S, Kiatpolpoj S, Innis BL, Rothman AL, Nisalak A, Ennis FA. Early clinical and laboratory indicators of acute dengue illness. J Infect Dis. 1997; 176(2):313-321

10. Wahid SF, Sansui S, Zawawi MM, Ali RA. A comparison of the pattern of liver involvement in dengue hemorrhagic fever. South east asian J Trop Med Public Health. 2000; 31(2): 259-263.

11. Nguyen TL, Nguyen NT, Tieu NT. The impact of dengue fever on liver function. Res Virol. 1997; 148(4): 273-277.