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**Research Article**

# A Study of Serum Aminotransferase Levels in Dengue Fever and Its Correlation with Clinical Profile

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## ABSTRACT

**BACKGROUND**: Dengue fever is one of the world's most common viral hemorrhagic fever diseases, the most geographically widespread of the arthropod-borne virus illnesses. Caused by arbovirus of Flavivirus genus with 4 serotypes. It is transmitted by Aedesaegypti, Aedesalbopictus. 4 spectra of illness are seen; an asymptomatic phase, acute febrile illness, classic Dengue fever (DF), Dengue Hemorrhagic Fever (DHF) which includes Dengue Shock Syndrome (DSS). Dengue viral infection has been recognized as one of the world's biggest emerging epidemics. Throughout the tropics this infection has an annual incidence of 100 million cases of DF with another 2, 50,000 cases of DHF and mortality rate of 24000-25000 per year. The involvement of liver in dengue fever has not been uncommon as reported in literature since 1970. Liver and nervous system involvement simultaneously predicts poor outcome in dengue fever. Atypical manifestations include liver involvement with elevation of enzymes, central nervous involvement (encephalopathy) and cardiac alterations (myocarditis). Liver involvement in dengue fever is manifested by the elevation of transaminases representing reactive hepatitis, due to direct attack of virus itself or the use of hepatotoxic drugs. **MATERIALS AND METHODS**: The study was performed on patients admitted for dengue fever in Medical College, Baroda. The total duration of the study was 10 months. **INCLUSION CRITERIA**: Dengue IgM positive **EXCLUSION CRITERIA**: Age <18 years, Chronic liver disease, Viral hepatitis (Hepatitis. A, Hepatitis. B, Hepatitis. C), Malaria, Leptospirosis, Typhoid, History of alcohol abuse. **RESULTS**: 85 patients reactive for dengue virus specific IgM/NS1 were studied. As per WHO classification, 39(45.88%) patients were classified as dengue without warning signs,32(37.65) patients as dengue with warning signs and 14(16.47) as severe dengue. Mean age of dengue infection was 23yrs with standard deviation of 8years with female predominance. Hepatic dysfunction is very common in all forms of dengue infection with AST rising significantly more than ALT. xi Serum aminotransferase levels appear to have a direct proportional correlation with grading of dengue infection. **CONCLUSION**: Serum aminotransferase levels are significantly raised in all forms of dengue infection, and it directly correlates with severity of infection. Serum aspartate aminotransferase was significantly raised compared to alanine aminotransferase levels in all forms of dengue infection. The degree of affection of serum albumin and prothrombin time which are absolute indicators of liver cell function correlated with severity of dengue infection.

**Key Words**: *Dengue fever, AST,ALT,Dengue shock syndrome*

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## INTRODUCTION

Dengue infection, an arthropod-borne viral hemorrhagic fever, continues to be a major challenge to public health, especially in South-East Asia. It has a wide geographical distribution and can present a diverse clinical spectrum. Although dengue virus is a non-hepatotoxic virus, liver injury due to dengue infection is not uncommon and has been described since the 1960s [1]. Hepatic involvement can be characterized by manifestations of acute hepatitis, with pain in the right hypochondrium, hepatomegaly, jaundice, and raised aminotransferase levels. In hepatitis, the levels of these enzymes reach a maximum on the ninth day after the onset of symptoms, and they gradually return to normal levels within three weeks. Although the liver is not the main target organ for this disease, histopathological findings, including centrilobular necrosis, fatty alterations, hyperplasia of the Kupffer cells, acidophil bodies and monocyte infiltration of the portal tract have been detected in patients with dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). In

most cases, hepatic involvement prolongs the clinical course of this self-limiting viral infection, but it does not constitute a sign of worse prognosis[2-3]. Liver dysfunction could be a direct viral effect or an adverse consequence of dysregulated host immune response against the virus [2]. Several outbreaks of dengue infection have been reported from India. However, large clinical studies documenting hepatic involvement in dengue infection, especially in adults, are scarce.

**MATERIALS AND METHOD**

The study was performed on patients admitted for dengue fever in M. S. Ramaiah medical college, Bangalore. Total duration of the study was 2 years[4]. INCLUSION CRITERIA • Dengue IgM positive. EXCLUSION CRITERIA -Age <18 years, -Malaria, -Typhoid, -Leptospirosis, -History of alcohol abuse. -Chronic liver disease, -Viral hepatitis (Hepatitis A, Hepatitis B, Hepatitis C). All patients were evaluated with detailed history including age, sex, presenting symptoms, history of co morbid illness, alcohol consumption and use of hepatotoxic drugs were noted. The World Health Organization (WHO) grading system was used to classify patients as having classic dengue fever (DF) and dengue hemorrhagic fever (DHF) (WHO, 1997)[5]. DHF was defined as fever with thrombocytopenia (platelet count less than 100,000/mm3 ) and evidence of plasma leakage as manifested by either a increase in hematocrit of ≥20% during the course of hospitalization or a rise in hematocrit to more than 20% of baseline (average normal hematocrit ratio for males: 0.45 and for females: 0.38) DHF was graded as DHF grade 1 (DHF-1, no spontaneous hemorrhage) and DHF grade 2 (DHF-2, with spontaneous hemorrhage)[6]. Dengue shock syndrome (DSS) was diagnosed if patient fulfilled criteria for DHF along with signs of shock as manifested by rapid and weak pulse, narrowing of pulse pressure, or hypotension (DHF-3); those with profound shock with unrecordable blood pressure and pulse were classified as DHF-4. 41 with warning signs without 1. Severe plasma leakage 2. Severe hemorrhage 3. Severe organ impairment A WHO/TDR-supported prospective clinical multicenter study across dengue. Endemic regions were set up to collect evidence about criteria for classifying dengue into levels of severity [7]. The study findings confirmed that, by using a set of clinical and/or laboratory parameters, one sees a clear-cut difference between patients with severe dengue and those with non-severe dengue. However, for practical reasons it was desirable to split the large group of patients with non-severe dengue into two subgroups- -patients with warning signs and those without them. Criteria for diagnosing dengue (with or without warning signs) andseveredengueareprepresentedinFigure1.4[8]. It must be kept in mind that even dengue patients without warning signs may develop severe dengue expert consensus groups in Latin America (Havana, Cuba, 2007), South-East Asia (Kuala Lumpur, Malaysia, 2007), and at WHO headquarters in Geneva, Switzerland in 2008 agreed that: "dengue is one disease entity with different clinical presentations and often with unpredictable clinical evolution and outcome"; the classification into levels of severity has a high potential for being of practical use in the clinicians' decision as to where and how intensively the patient should be observed and treated (i.e. triage, which is particularly useful in outbreaks), in more consistent reporting in the national and international surveillance system, and as an end-point measure in dengue vaccine and drug trials[8]

Figure 1.4 Suggested dengue case classification and levels of severity


## CRITERIA FOR DENGUE ± WARNING SIGNS

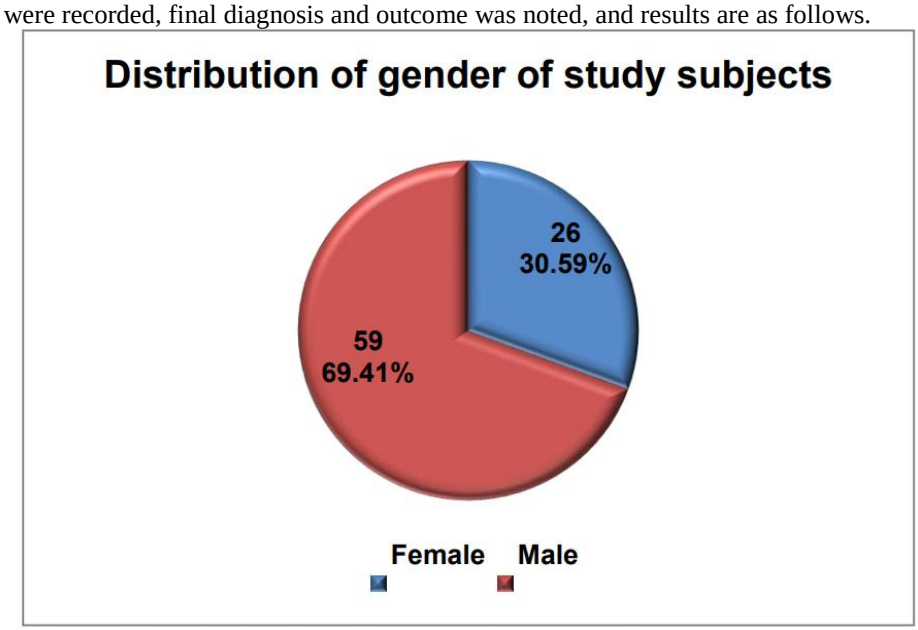
Probable dengue live in /travel to dengue endemic area. Fever and 2 of the following criteria: • Nausea, vomiting •Rash • Aches and pains • Tourniquet test positive • Leukopenia • Any warning sign 42 Warning signs* •Abdominal pain or tenderness •Persistent vomiting •Clinical fluid accumulation •Mucosal bleed •Lethargy, restlessness •Liver enlargement >2 cm •Laboratory: increase in HCT concurrent with rapid decrease in platelet count CRITERIA FOR SEVERE DENGUE Severe plasma leakage Leading to: •Shock (DSS) •Fluid accumulation with respiratory distress Severe bleeding as evaluated by clinician Severe organ involvement •Liver: AST or ALT>=1000 •CNS: Impaired consciousness •Heart and other organs[9].

Examination- Vitals parameters and systemic examination were done. Investigations- The following investigations were done with special emphasis; Dengue serology: Done by immune chromatographic method. Liver function test: AST and ALT were estimated by IFCC (International Federation of Clinical Chemistry) without pyridoxal phosphate activation. Total bilirubin, total protein, albumin and ALP were estimated by colorimetric assay. Routine investigations Hemoglobin percentage, total count, ESR, Packed cell volume (PCV), Platelet count, PT and APTT, blood urea, serum creatinine, and blood sugar estimation were done[6]. Statistical analysis Descriptive statistical analysis has been carried

out in the present study. Results on continuous measurements are presented on Mean  SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance[10]. The following assumptions on data are made, Assumptions: 1. Dependent variables should be normally distributed, 2. Samples drawn from the population should be random, Cases of the samples should be independent Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. 1. Sample Size estimation Proportion Known populations n = [(z 2 * p * q) + ME2] / [ME2 + z 2 * p * q / N] Proportion Unknown population. n = [ (z2 * p * q) + ME2] / (ME2 ) ME: is the margin of error, measure of precision and Z is 1.96 as critical value at 95%CI N: population size n: Sample size σ: Standard deviation z: Critical value based on Normal distribution at 95% Confidence Interval.2 Analysis of Variance: F test for K Population means Objective: To test the hypothesis that K samples from K Populations with the same mean. The mathematical model that describes the relationship between the response and treatment for the one-way ANOVA is given by Yij =  +i + ij Where Yij represents the j-th observation (j = 1, 2 ...ni) on the Ith treatment (i = 1, 2... k levels) Limitations: It is assumed that populations are normally distributed and have equal variance. It is also assumed that samples are independent of each other. 3. Chi-Square Test: The chi-square test for independence is used to determine the relationship between two variables of a sample. In this context independence means that the two factors are not related. In the chi-square test for independence the degree of freedom is equal to the number of columns in the table minus one multiplied by the number of rows in the table minus on. Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

**RESULTS**

Prospective observational study was conducted in SSG hospital, Vadodara. 85 patients with dengue NS1 and/or dengue IgM positive and admitted to the inpatient medicine department were included in the study. Serum SGOT and serum SGPT levels were recorded, final diagnosis and outcome was noted, and results are as follows.




1: -Distribution of demographic characteristics of study subjects.

**Table 1:-Distribution of demographic characteristics of study subjects.**

| Demographic characteristics | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Female | 26 | 30.59% |
| Male | 59 | 69.41% |
| **Age(years)** | | |
| Mean ± SD | 23.07 ± 8 | |
| Median(25th-75th percentile) | 22(18-27) | |

In present study, 69.41% of patients were males and 30.59% of patients were females. Mean value of age(years) of study subjects was 23.07 ± 8 with median (25th-75th percentile) of 22(18-27). It is shown in table 1, figure 1.1

2: -Distribution of symptoms of study subjects.

**Table 2:-Distribution of symptoms of study subjects.**

| Symptoms | Frequency | Percentage |
|---|---|---|
| Fever | 85 | 100.00% |
| Headache | 39 | 45.88% |
| Retro orbital pain | 14 | 16.47% |
| Arthralgia | 25 | 29.41% |
| Myalgia | 66 | 77.65% |
| Vomiting | 51 | 60.00% |
| Abdominal pain | 19 | 22.35% |
| Bleeding | 9 | 10.59% |
| Altered sensorium | 3 | 3.53% |
| Jaundice | 2 | 2.35% |
| Rash | 9 | 10.59% |

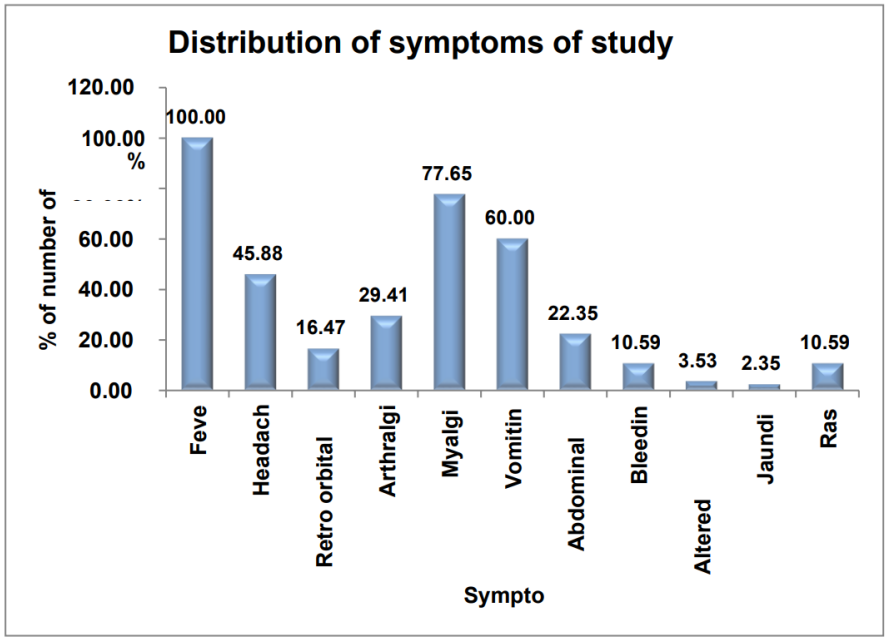



**Figure 2:-Distribution of symptoms of study subjects.**

In the present study, all the patients had fever followed by myalgia (77.65%), vomiting (60.00%), headache (45.88%), arthralgia (29.41%), abdominal pain (22.35%), retro orbital pain (16.47%), bleeding (10.59%), rash (10.59%) and altered sensorium (3.53%). Jaundice was present in only 2 out of 85 patients (2.35%). It is shown in table 2, figure 2[11].

3: -Distribution of blood pressure(mmHg) of study subjects.

**Table 3:-Distribution of blood pressure(mmHg) of study subjects.**

| Blood pressure(mmHg) | Frequency | Percentage |
|---|---|---|
| **Systolic blood pressure(mmHg)** | | |
| <90 | 7 | 8.24% |
| 90 to <100 | 10 | 11.76% |
| >=100 | 68 | 80.00% |
| Mean ± SD | 105.51 ± 13.11 | |
| Median(25th-75th percentile) | 108(100-110) | |
| Range | 80-144 | |
| **Diastolic blood pressure(mmHg)** | | |
| Mean ± SD | 69.48 ± 7.36 | |
| Median(25th-75th percentile) | 70(70-70) | |
| Range | 50-90 | |

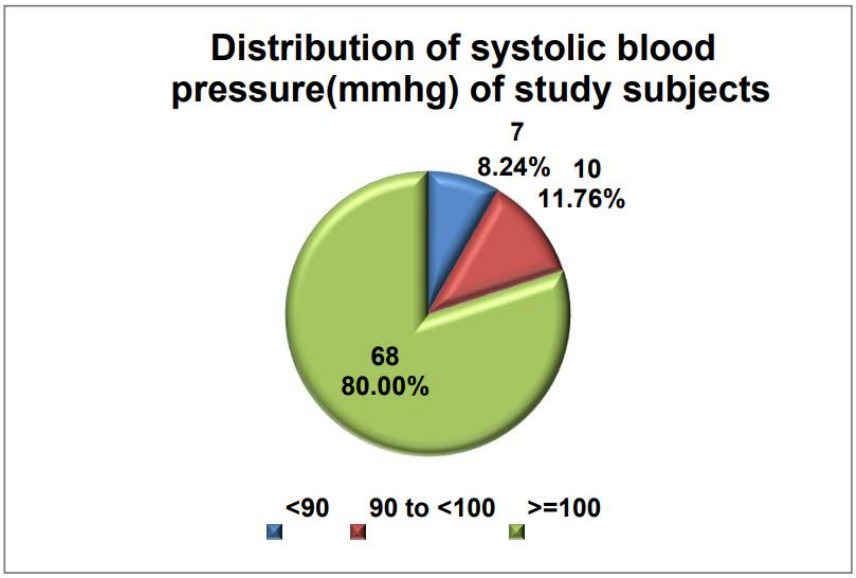



**Figure 3.1:-Distribution of systolic blood pressure(mm hg) of study subjects**

In present study, in majority (80.00%) of patients, systolic blood pressure(mmHg) was >=100 followed by 90 to <100 (11.76%). Systolic blood pressure(mmHg) was <90 in only 7 out of 85 patients (8.24%). Mean value of systolic blood pressure(mmHg) of study subjects was 105.51 ± 13.11 with median (25th-75th percentile) of 108(100-110). Mean value of diastolic blood pressure (mmHg) of study subjects was 69.48 ± 7.36 with median (25th-75th percentile) of 70(70-70). It is shown in table 3, figure 3.1

4:-Distribution of hess test of study subjects

**Table 4:-Distribution of hess test of study subjects.**

| Hess test | Frequency | Percentage |
|---|---|---|
| Negative | 45 | 52.94% |
| Positive | 40 | 47.06% |
| Total | 85 | 100.00% |

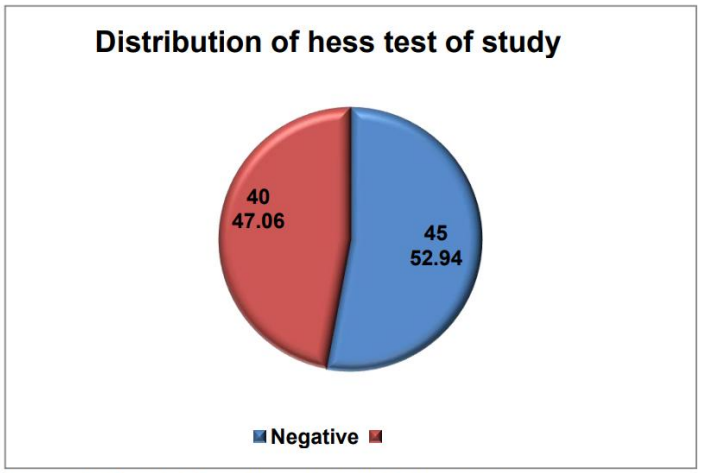
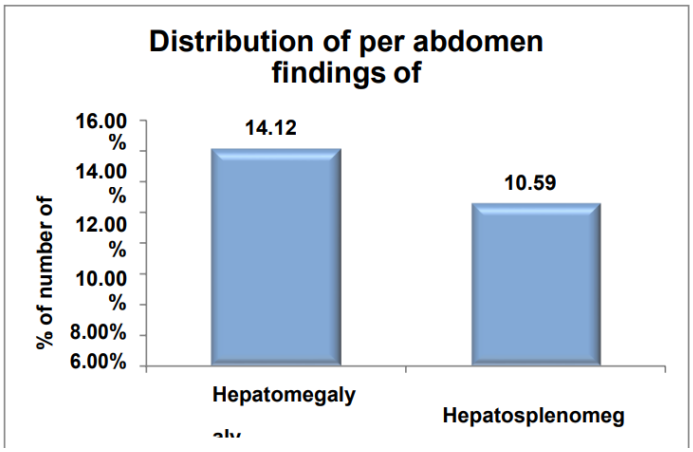



**Figure 4:-Distribution of hess test of study subjects.**

In present study, in 52.94% of patients, hess test was negative. Hess test was positive in only 40 out of 85 patients (47.06%). It is shown in table 4, figure 4.

5 – Distribution of per abdomen findings

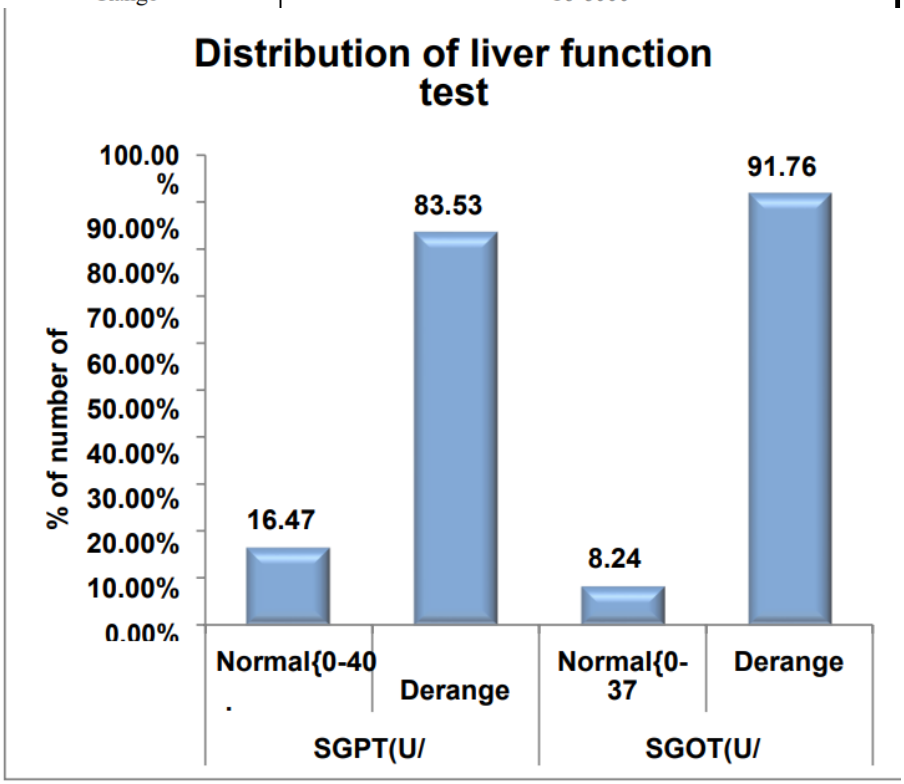
| Per abdomen findings | Frequency | Percentage |
|---|---|---|
| Hepatomegaly | 12 | 14.12% |
| Hepatosplenomegaly | 9 | 10.59% |




In the present study, in 14.12% of patients, hepatomegaly was seen. Per abdomen findings was hepatosplenomegaly in only 9 out of 85 patients (10.59%)

6 – Distribution of liver function test parameters of study subjects

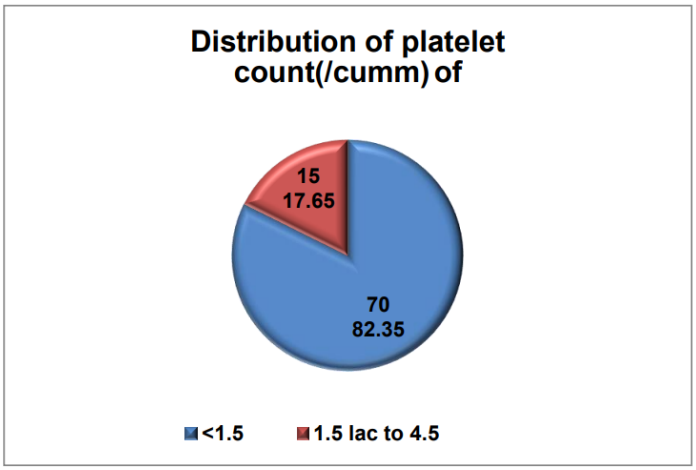
| Liver function test parameters | Frequency | Percentage |
|---|---|---|
| **SGPT(U/L)** | | |
| Normal{0-40 U/L} | 14 | 16.47% |
| Deranged | 71 | 83.53% |
| Mean ± SD | 221.73 ± 418.1 | |
| Median(25th-75th percentile) | 142(58-218) | |
| Range | 6-3610 | |
| **SGOT(U/L)** | | |
| Normal{0-37 U/L} | 7 | 8.24% |
| Deranged | 78 | 91.76% |
| Mean ± SD | 307.68 ± 760.06 | |
| Median(25th-75th percentile) | 173(76-259) | |
| Range | 16-6000 | |




In the present study, in the majority (83.53%) of patients, SGPT(U/L) was deranged. SGPT(U/L) was normal {0-40 U/L} in only 14 out of 85 patients (16.47%). Mean value of SGPT(U/L) of study subjects was 221.73 ± 418.1 with median (25th-75th percentile) of 142(58-218). In the majority (91.76%) of patients, SGOT(U/L) was deranged. SGOT(U/L) was normal {0-37 U/L} in only 7 out of 85 patients (8.24%). Mean value of SGOT(U/L) of study subjects was 307.68 ± 760.06 with median (25th-75th percentile) of 173(76-259[12].

7-Distribution of platelet count(/cumm) of study subject

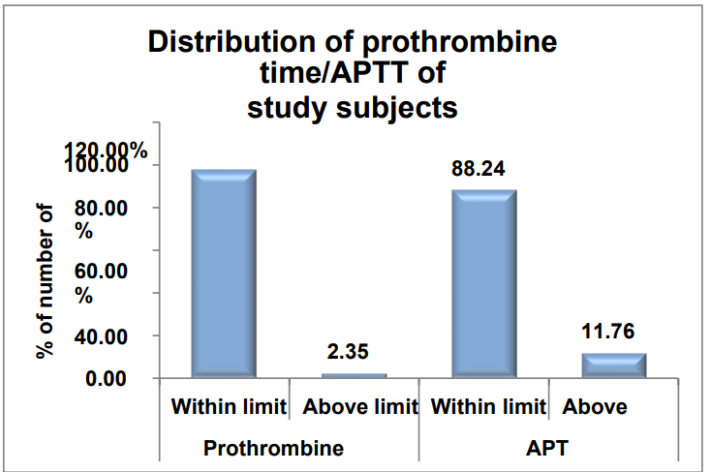
| Platelet count(/cumm) | Frequency | Percentage |
|---|---|---|
| <1.5 lac | 70 | 82.35% |
| 1.5 lac to 4.5 lac/cumm | 15 | 17.65% |
| Mean ± SD | 77752.94 ± 71865.6 | |
| Median(25th-75th percentile) | 46000(28000-109000) | |
| Range | 6000-308000 | |




In present study, in majority (82.35%) of patients, platelet count(/Cumm) was <1.5 lac. Platelet count(/Cumm) was lac to 4.5 lac/Cumm in only 15 out of 85 patients (17.65%). Mean value of platelet count(/Cumm) of study subjects was 77752.94 ± 71865.6 with median (25th-75th percentile) of 46000(28000-109000)

8-Distribution of prothrombin time/APTT of study subjects

| Prothrombin time/APTT | Frequency | Percentage |
|---|---|---|
| **Prothrombin time** | | |
| Within limit | 83 | 97.65% |
| Above limit | 2 | 2.35% |
| **APTT** | | |
| Within limit | 75 | 88.24% |
| Above limit | 10 | 11.76% |




In the present study, in the majority (97.65%) of patients, prothrombin time was within the limit. Prothrombin time was above limit in only 2 out of 85 patients (2.35%). In the majority (88.24%) of patients, APTT was within limit. APTT was above limit in only 10 out of 85 patients (11.76%).

9 Distribution of final diagnosis of study subjects

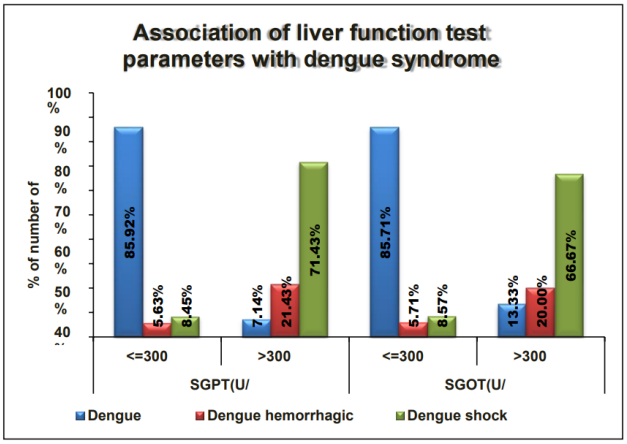
| Final diagnosis | Frequency | Percentage |
|---|---|---|
| Dengue without warning sign | 39 | 45.88% |
| Dengue with warning signs | 32 | 37.65% |
| Severe dengue | 14 | 16.47% |
| Total | 85 | 100.00% |

In the present study, in the majority (72.94%) of patients, syndrome was dengue fever followed by dengue shock syndrome (18.82%). Syndrome was dengue hemorrhagic fever in only 7 out of 85 patients (8.24%)

10-Association of liver function test parameters with dengue syndrome.

| Liver function test parameters | Dengue fever(n=62) | Dengue hemorrhagic fever(n=7) | Dengue shock syndrome(n=16) | Total | P value |
|---|---|---|---|---|---|
| **SGPT(U/L)** | | | | | |
| <=300 U/L | 61 (85.92%) | 4 (5.63%) | 6 (8.45%) | 71 (100%) | <.0001* |
| >300 U/L | 1 (7.14%) | 3 (21.43%) | 10 (71.43%) | 14 (100%) | |
| Mean ± SD | 107.81 ± 80.36 | 385.71 ± 376.15 | 591.44 ± 827.09 | 221.73 ± 418.1 | <.0001‡ |
| Median(25th-75th percentile) | 86(47.25-174.5) | 220(181-463) | 436(227.75-523) | 142(58-218) | |
| Range | 6-386 | 32-1160 | 78-3610 | 6-3610 | |
| **SGOT(U/L)** | | | | | |
| <=300 U/L | 60 (85.71%) | 4 (5.71%) | 6 (8.57%) | 70 (100%) | <.0001* |
| >300 U/L | 2 (13.33%) | 3 (20%) | 10 (66.67%) | 15 (100%) | |
| Mean ± SD | 128.32 ± 84.54 | 790.86 ± 1365.07 | 791.31 ± 1403.28 | 307.68 ± 760.06 | <.0001‡ |
| Median(25th-75th percentile) | 98.5(67-197) | 240(193.5-496) | 500(286.75-619.25) | 173(76-259) | |
| Range | 16-393 | 53-3864 | 111-6000 | 16-6000 | |

* Fisher's exact test, ‡ Kruskal Wallis test

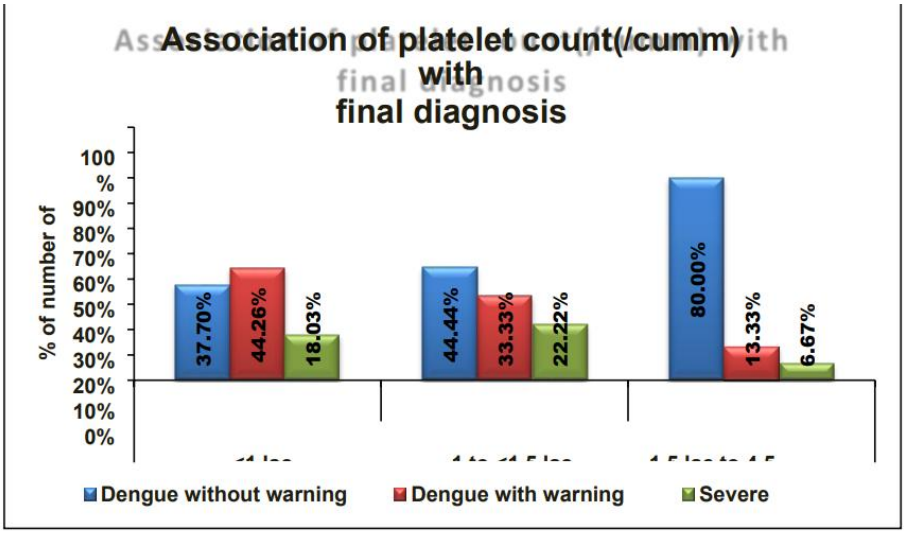



Proportion of patients with dengue fever was significantly higher in SGPT <=300 U/L (85.92%) as compared to SGPT >300 U/L (7.14%). Proportion of patients with dengue hemorrhagic fever and dengue shock syndrome was significantly higher in >300 U/L (21.43%, 71.43% respectively) as compared to SGPT <=300 U/L (5.63%, 8.45% respectively). (p value <.0001) Proportion of patients with dengue fever was significantly higher in SGOT <=300 U/L (85.71%) as compared to SGOT >300 U/L (13.33%). Proportion of patients with dengue hemorrhagic fever and dengue shock syndrome was significantly higher in SGOT >300 U/L (20%, 66.67% respectively) as compared to <=300 U/L (5.71%, 8.57% respectively). (p value <.0001) Median (25th-75th percentile) of SGPT(U/L) in dengue shock syndrome was 436(227.75-523)[13], which was significantly higher as compared to dengue hemorrhagic fever (220(181-463)) and dengue fever (86(47.25- 174.5)). (p value<.0001) Median (25th-75th percentile) of SGOT(U/L) in dengue shock syndrome was 500(286.75-619.25) which was significantly higher as compared to dengue hemorrhagic fever (240(193.5-496)) and dengue fever (98.5(67-197))[13].

11- Association of platelet count(/Cumm) with final diagnosis.

| Platelet count(/cumm) | Dengue without warning sign(n=39) | Dengue with warning signs(n=32) | Severe dengue(n=14) | Total | P value |
|---|---|---|---|---|---|
| <1 lac | 23 (37.70%) | 27 (44.26%) | 11 (18.03%) | 61 (100%) | 0.055* |
| 1 to <1.5 lac | 4 (44.44%) | 3 (33.33%) | 2 (22.22%) | 9 (100%) | |
| 1.5 lac to 4.5 lac/cumm | 12 (80%) | 2 (13.33%) | 1 (6.67%) | 15 (100%) | |
| Total | 39 (45.88%) | 32 (37.65%) | 14 (16.47%) | 85 (100%) | |

* Fisher's exact test

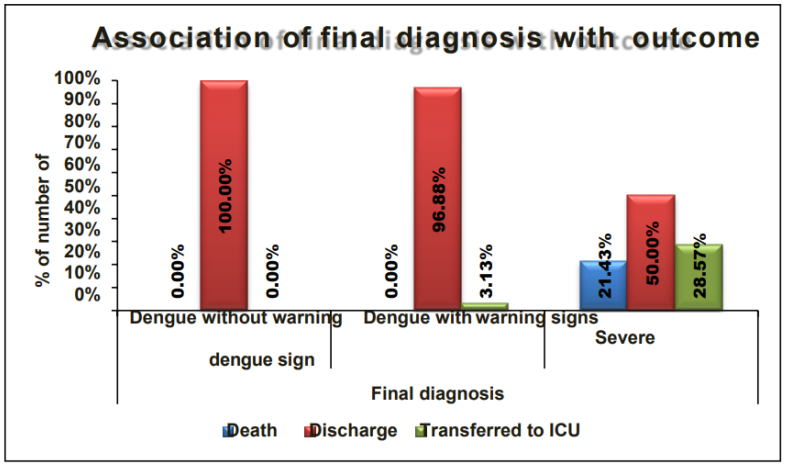



Distribution of final diagnosis was comparable with platelet count(/Cumm) {<1 lac, 1 to <1.5 lac and 1.5 to 4.5 lac}. (Dengue without warning sign:-<1 lac(37.70%) vs 1 to <1.5 lac(44.44%) vs 1.5 lac to 4.5 lac/Cumm(80%), dengue with warning signs:- <1 lac(44.26%) vs 1 to <1.5 lac(33.33%) vs 1.5 lac to 4.5 lac/Cumm(13.33%), severe dengue:-<1 lac(18.03%) vs 1 to <1.5 lac(22.22%) vs 1.5 lac to 4.5 lac/Cumm(6.67%)) (p value=0.055)

12 Association of final diagnosis with outcome

| Final diagnosis | Death(n=3) | Discharge(n=77) | Transferred to ICU(n=5) | Total | P value |
|---|---|---|---|---|---|
| Dengue without warning sign | 0 (0%) | 39 (100%) | 0 (0%) | 39 (100%) | <.0001* |
| Dengue with warning signs | 0 (0%) | 31 (96.88%) | 1 (3.13%) | 32 (100%) | |
| Severe dengue | 3 (21.43%) | 7 (50%) | 4 (28.57%) | 14 (100%) | |
| Total | 3 (3.53%) | 77 (90.59%) | 5 (5.88%) | 85 (100%) | |

* **Fisher's exact test**




Proportion of died patients was significantly higher in severe dengue (21.43%) as compared to dengue without warning sign (0%), dengue with warning signs (0%). The proportion of patients who were transferred to ICU was significantly higher in severe dengue (28.57%) as compared to dengue without warning sign (0%), dengue with warning signs (3.13%). (p value <.0001)[14].

## DISCUSSION

A prospective observational study was conducted in SSG hospital, Vadodara. 85 patients with dengue NS1 and/or dengue IgM positive and admitted to the inpatient medicine department were included in the study. Serum SGOT and serum SGPT levels were recorded, final diagnosis and outcome was noted, and results are as follows.

The following inferences were drawn from the studies

1. In present study, 69.41% of patients were males and 30.59% of patients were females. Mean value of age(years) of study subjects was 23.07 ± 8 with median (25th-75th percentile) of 22(18-27).
2. In present study, all the patients had fever followed by myalgia (77.65%), vomiting (60.00%), headache (45.88%), arthralgia (29.41%), abdominal pain (22.35%), retro orbital pain (16.47%), bleeding (10.59%), rash (10.59%) and altered sensorium (3.53%). Jaundice was present in only 2 out of 85 patients (2.35%)
3. In the present study, in 52.94% of patients, Hess test was negative. Hess test was positive in only 40 out of 85 patients (47.06%)
4. In the present study, in 14.12% of patients, hepatomegaly was seen. Per abdomen findings was hepatosplenomegaly in only 9 out of 85 patients (10.59%)
5. In the present study, in the majority (83.53%) of patients, SGPT(U/L) was deranged. SGPT(U/L) was normal {0-40 U/L} in only 14 out of 85 patients (16.47%). Mean value of SGPT(U/L) of study subjects was 221.73 ± 418.1 with median (25th-75th percentile) of 142(58-218)
6. 6 In majority (91.76%) of patients, SGOT(U/L) was deranged. SGOT(U/L) was normal {0- 37 U/L} in only 7 out of 85 patients (8.24%). Mean value of SGOT(U/L) of study subjects was 307.68 ± 760.06 with median (25th-75th percentile) of 173(76-259)
7. 7. In the present study, in the majority (97.65%) of patients, prothrombin time was within limit. Prothrombin time was above limit in only 2 out of 85 patients (2.35%)
8. 8 Median (25th-75th percentile) of SGPT(U/L) in dengue shock syndrome was 436(227.75- 523) which was significantly higher as compared to dengue hemorrhagic fever (220(181- 463)) and dengue fever (86(47.25-174.5)). (p value<.0001)
9. 9 Median (25th-75th percentile) of SGPT(U/L) in severe dengue was 517(446.5-596.5) which was significantly higher as compared to dengue with warning signs (183.5(167.25- 206)) and dengue without warning sign (52(22-80)).
10. 10 Median (25th-75th percentile) of SGPT(U/L) in severe dengue was 517(446.5-596.5) which was significantly higher as compared to dengue with warning signs (183.5(167.25- 206)) and dengue without warning sign (52(22-80))

## CONCLUSION

Serum aminotransferase levels are significantly raised in all forms of dengue infection and it directly correlates with severity of infection. Serum aspartate aminotransferase was significantly raised compared to alanine aminotransferase levels in all forms of dengue infection. The degree of affection of serum albumin and prothrombin time which are absolute indicators of liver cell function correlated with severity of dengue infection.

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