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Original Research Article

Serum lipid profile as predictor of clinical outcome in pediatric patients with dengue infection at a tertiary care hospital

Mohd. Saeed S. Siddiqui, Amruta K. Loya*, Udaykumar Kanumala, Jagannath R. Kakade

Department of Pediatrics, MGM Medical College and Hospital, Aurangabad, Maharashtra, India

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***Correspondence:**
Dr. Amruta K. Loya,
E-mail: dramrutaloya@gmail.com

ABSTRACT

Background: Dengue is a serious mosquito-borne viral disease which in recent years has become a major international public health concern. Early detection of individuals at risk of developing severe forms of dengue could be possible with the identification of an ideal biomarker, which has been the focus of several research studies. Changes in lipoprotein profile during infection probably are primarily cytokine induced Interactions between microorganisms and lipoproteins occur in viral infections. There have been very few studies that address and elucidate a correlation between dengue fever severity and changes in the lipid profile.
Methods: This study was conducted in paediatric patients with dengue infection of age group between 1 to 18 years MGM Medical College and Tertiary Care Hospital of Aurangabad City.
Results: There was statistically significant association between TG (mg/dl) level and dengue disease category (DF vs DHS+DSS) among the patients. Overall the combine lipids were significantly predicting dengue disease category (DF, DHS and DSS). Serum lipids (triglycerides, LDL and cholesterol) among the patients significantly predict dengue disease category (DF, DHS and DSS). There was negative correlation between triglycerides level and HDL and hospital Stay which was found to be statistically significant.
Conclusions: Reduced serum lipid profile can be used as a cost-effective laboratory investigation prompting a high suspicion of severe dengue infection especially in resource poor setting where serological tests may not be available.

Keywords: Biomarkers, Dengue, Lipid profile, Platelet count

INTRODUCTION

Dengue is a serious mosquito-borne viral disease which in recent years has become a major international public health concern. Dengue Fever (DF) remains the most rapidly spreading mosquito-borne viral disease worldwide and in recent decades a re-emergence of the virus and its severe forms has been observed.[1] Found in the tropical and sub-tropical regions of the world, over 2.5 billion people live in dengue endemic countries, It is the most serious viral hemorrhagic fever in the world with an annual incidence of 100 million cases per year.[2] Of those diagnosed, an estimated 50,0000 people, the majority being children, develop severe forms of dengue and require hospitalization annually. About 2.5% of those affected do not survive.[3] In recent years, increases in incidence have partly been attributed to urbanization and air travel and infections are only expected to rise.[3]

Early detection of individuals at risk of developing severe forms of dengue could be possible with the identification of an ideal biomarker, which has been the focus of several research studies. While the mechanism behind individuals who contract DF and progress to severe dengue remains unclear; research speculates that the host immune response is a significant factor in dengue pathogenesis and suggest severe forms are most likely associated with immunopathology.[3] This has led to the

examination of immune response components, endothelial activation markers, and other biochemical and genetic markers as potential biomarkers.[3,4] The World Health Organization (WHO) encourages research based around markers of severity to develop new tools and methods that can reduce the healthcare burden of dengue infection in endemic countries.

From largely derived data from experiments involving humans and animals, it is said that lipid metabolism and cytokines are linked. The interaction is bidirectional. Lipids are involved in regulation of cytokine levels and thereby modify host immune response. On the other hand, cytokines are known to have the ability to modify lipid metabolism lipoproteins are thought to play a pathophysiological role in host immune response during severe infection.[1] Changes in lipoprotein profile during infection probably are primarily cytokine induced Interactions between microorganisms and lipoproteins occur in viral infections.

Theories postulate that the immunopathogenesis of dengue infections demonstrate the possibility of lipoprotein's ability to modify inflammatory immune function and host immune response during infections.[5] Research also suggests that during viral infections, lipoproteins bind to viruses and neutralize their negative effects, while certain viruses use LDL receptors for entrance into cells.[6]

Research also demonstrated that using markers to indicate thrombocytopenia and hemorrhagic manifestations have been associated with severe forms of dengue. Despite several studies looking at possible biomarkers to indicate severe forms of dengue, there have been few studies that address and elucidate a correlation between dengue fever severity and changes in the lipid profile.[7]

This study is done to find out correlation of serum lipoproteins levels with

- Dengue severity
- Clinical outcome
- Supportive care requirement and hospital stay

Several biochemical compounds are shown to be either elevated or decreased in serum/plasma of patients with severe dengue and quantifying them might serve as biomarkers of severe dengue disease. Levels of total plasma cholesterol, High-Density Lipoprotein (HDL) and Low-Density Lipoprotein (LDL) were significantly decreased in children with the severest disease compared with patients with mild DHF.[8]

Microbial translocation occurs during severe DENV infection and Lipopolysaccharide (LPS) levels are significantly increased in dengue patients which is indicated by elevated levels of LPS Binding Protein (LBP) and soluble CD14 (sCD14). Elevated LPS levels in dengue patients were found to correlate with clinical disease severity.

Liver injury is associated with severe dengue disease with the increase in serum Aspartate Amino transferase (AST), Alanine Amino Transferase (ALT), gamma-glutamyl transpeptidase, alkaline phosphatase, and serum albumin concentrations. Reports showed that the AST and ALT levels were high in severe disease and may serve as predictors of severe disease.[9]

Children with DSS and liver injury have lower zinc levels and the low levels were probably caused by loss from diarrhea and from zinc translocating to liver cells.[10] The Inter-α Inhibitor Proteins (IaIp) belong to a family of serine protease inhibitors and its concentrations in pediatric patients suffering from severe DENV infection were significantly lower than in patients with mild DF and healthy controls.[11] NO is known to have a strong immunoregulatory role and in adjusting the diameter of blood vessels, remodeling blood vessels, inhibiting leukocyte adhesion, platelet aggregation, and contractile cell proliferation.[12] Serum NO levels in DHF patients were shown to be significantly lower than those of the DF patients.[13] Thus, increased levels of LPS, AST, ALT and decreased levels of lipids, IaIp and NO might serve as markers of severe dengue disease.

Hober D studied the patients in which High levels of TNF-alpha were observed in dengue-infected children of all severity grades.[14] The highest values were observed in DSS. High values of IL-6 were observed in serum samples of mild infections on day 1, which decreased on day 4, and by day 5 were similar to those obtained from 25 control children. In shock, the highest values of IL-6 were observed from day 3 to day 5 after the onset of infection; after day 5, these values were very low.

Eric CM studied and showed Levels of total plasma cholesterol, high-density lipoprotein, and low-density lipoprotein were significantly decreased in patients with the severest cases, compared with patients with mild DHF and healthy controls.[15]

In 2003, Dunham reported that in critically ill trauma patients, mean serum TC was low at admission than the normal population.[16] In addition, the non-survivors showed a significant decline in serum TC levels as compared to the survivors. In another study low serum total cholesterol strongly correlated with disease severity in dengue fever.

Suvarna and Rane during 2006 In a prospective study conducted over 18 months at a tertiary care hospital, lowest cholesterol, VLDL levels seen in DSS and highest in DF.[17] Mean cholesterol level is significantly lower in expired patients and patients with third spacing. Severe bleeding significantly correlated with cholesterol level and hepatic dysfunction but not with platelet count or coagulopathy. Duration of intravenous fluid requirement

and packed cell requirement negatively correlated with HDL and cholesterol levels. Fresh frozen plasma requirement negatively correlated with TG, HDL, VLDL and cholesterol levels. Platelet transfusion requirement and duration of hospital stay did not correlate with lipid levels. Intensive care and ventilator requirement negatively correlated with cholesterol level; inotrope requirement negatively correlated with HDL level. Ventilator requirement correlated negatively with TG levels also.

METHODS

Research design was the research design selected for this study is cross sectional observation study. Settings of the study was This study was conducted in pediatric patients with Dengue Infection of Age Group between 1 to 18 years MGM medical college and tertiary care hospital of Aurangabad City. Period of Study was the study was conducted during 1st November 2015 to 31st October. 2017. Sampling technique was all dengue positive cases in pediatric patients in MGM medical college and tertiary care hospital.

Inclusion criteria

- All confirmed dengue cases in 1-18 yrs age group
- Willing to participate in study

Study population was the population for this study includes proven cases of dengue children of age group between 1 to 18 year of tertiary care hospital of Aurangabad city.

Sample size

Based on a study done by the sample size of 45 is required to estimate the prevalence of dengue to be 3%.

$$n = \frac{z2p(1-p)}{d2}$$

Table 1: Criteria for dengue fever, dengue haemorrhagic fever, dengue shock syndrome.

Illness	Clinical features
DF	Acute febrile illness with ‡2 of the following: (a) headache, (b) retro-orbital pain, (c) myalgia, (d) rash, (e) hemorrhagic manifestations, and (f) leucopenia and Supportive serology
DHF	1. Fever or recent history of acute fever lasting 2-7 days, occasionally biphasic. 2. Hemorrhagic tendencies evidenced by at least one of the following: (a) positive tourniquet test, (b) petechiae/ecchymosis/purpura, (c) bleeding from the mucosa gastrointestinal tract/injection sites/other locations, (d) hematemesis/melaena. 3. Low platelet count (ℒ1 lac/mm^3). 4. Objective evidence of 'leaky capillaries' manifested by at least one of the following: (a) elevated hematocrit (20% or more over baseline), (b) drop in hematocrit‡ 20% of baseline after volume replacement treatment, and (c) signs of plasma leakage like pleural effusion, ascites and hypo-proteinemia. A positive tourniquet test result and/or easy bruising, without spontaneous bleeding characterizes DHF grade 1. Spontaneous bleeding is seen in DHF grade 2
DSS	All the four criteria for DHF plus evidence of circulatory failure manifested by: (a) rapid and weak pulse, (b) narrow pulse pressure <20 mm Hg, (c) hypotension for age, and (d) cold clammy skin and restlessness characterize DHF grade 3. Frank shock-undetectable pulse or blood pressure characterizes DHF grade 4.

Approval for the study was obtained from the Institutional Ethical Committee of MGM Medical College and Hospital, Aurangabad, Maharashtra, India.

Demographic profile was collected which included age in years, gender, Religion, area of living, anthropometry i.e. height, weight etc. History, clinical examination ad laboratory findings were noted. Blood Sample (2cc) is collected on day 1 of admission (venous blood sample was collected).

- Complete blood picture - ADVIA 5PART
- Dengue serology - SD Bioline Dengue Duo rapid test
- Lipid profile - SEIMEN DIMENSION RXL

Specimen processing

Serum was separated by standard methods and tested simultaneously for NS1 antigen and IgM and IgG anti dengue antibodies by ICT (SD Bioline Dengue Duo rapid test). The instructions of the manufacturers were meticulously followed while performing the tests and results were interpreted.

Hematological parameters

Platelet count and Total Leucocyte Count (TLC) of seropositive patients were noted. Thrombocytopenia was defined as a platelet count of <100,000/µl and

Leucopenia was defined as a leucocyte count of <5000/µl.[2]

Serological classification of Primary and Secondary dengue infection[2]

NS1, NS1+IgM, IgM positive patients were labelled as primary while NS1+IgM+IgG, NS1+IgG, IgG positive patients were labelled as secondary dengue infection. IgM+IgG positive patients couldn't be classified as ELISA was not done to assess the ratio of IgM/IgG.

Statistical analysis

Data was entered in Microsoft Excel and analyzed using SPSS version 24.0. Mean and Standard deviation were calculated for quantitative variables, and proportion will be calculated for categorical variables. To assess the association of risk factors with severity of dengue, Chi square test for categorical variables will be used. p value of <0.05 will be considered statistically significant.

RESULTS

Dengue disease category

In present study 50 dengue patients were studied in MGM Medical College and Hospital Aurangabad. Out of 50 dengue patients, 30(60.0%) patients were from Dengue fever, 12(24.0%) and 8(16.0%) were occurred in Dengue Disease category of Dengue Hemorrhagic Fever and Dengue Shock Syndrome respectively [Table 2].

Age distribution amongst dengue disease category

In present study maximum i.e. 14(28.0%) patients were from age group of 6-10 years. The mean age of patients was 8.29 years with SD of 4.50 years. There was not significant association between Dengue disease category and age-group [p=0.956].

Table 2: Distribution of patients according to dengue disease category.

Dengue Disease category	No. of patients	%
Dengue Fever	30	60.0%
Dengue Hemorrhagic Fever	12	24.0%
Dengue Shock Syndrome	08	16.0%
Totals	50	100%

Frequency of presenting complains

All the patient's complaint fever, 14(28.0%) and 11(22.0%) patients were complaining abdominal pain and rash respectively. Only 03(6.0%) of patients complain black colour stool.

Table 3: Comparison of mean lipid profiles in dengue disease category.

Lipid profile	category	Mean	SD	95% Confidence interval		ANOVA F-value	p value
				Lower bound	Upper bound		
Triglycerides	DF	240.23	28.04	229.76	250.71	38.53	P<0.0001 S
	DHF	191.67	14.37	182.53	200.80		
	DSS	165.50	18.60	149.94	181.06		
HDL	DF	34.00	6.61	31.53	36.47	6.81	P=0.003 S
	DHF	32.08	10.74	25.26	38.91		
	DSS	23.00	3.89	19.75	26.25		
LDL	DF	42.97	14.19	37.67	48.27	11.07	P<0.0001 S
	DHF	29.20	4.00	23.66	28.74		
	DSS	26.38	5.37	24.89	33.86		
Cholesterol	DF	111.93	15.20	106.26	117.61	27.04	P<0.0001 S
	DHF	95.83	11.59	88.47	103.20		
	DSS	73.13	9.12	65.51	80.74		

Lipid profiles in dengue disease category

There was statistically significant difference between mean Triglycerides and Dengue disease category [p<0.0001]. The mean Triglycerides levels were less in DSS and DHF as compared to DF. Also, Significant findings was noted in other mean lipid profile i.e. HDL, LDL and cholesterol levels in Dengue disease category. [Table 3].

The mean difference of Triglycerides level of DF and DHF was 45.56 this difference was statistically significant (p<0.001) and mean difference of Triglycerides level of DF and DSS was 74.17 this difference was statistically significant (p<0.0001). The

mean difference of Triglycerides level of DHF and DSS was 26.17 and difference was not statistically significant (p=0.070).

The mean difference of HDL level of DF and DHF was 1.92 and difference was not statistically significant (p=0.757). Whereas in LDL, the mean difference of LDL level of DHF and DSS was 2.86 and difference was not statistically significant (p=0.167) [Table 4].

Triglycerides level in dengue disease category

There was statistically significant association between TG (mg/dl) level and dengue disease category (DF vs DHS+DSS) among the patients (p<0.021). The Odds of having DSS were times 9.66 more if TG<150 mg⁄dl, then when TG>150 mg⁄dl [Table 5].

Table 4: Comparison of Mean Difference between two dengue fever categories in lipid profile [scheffe post hoc test].

Particular		Mean Difference	p-value
Triglycerides	DF Vs DHF	48.56	p<0.0001 S
	DF Vs DSS	74.73	p<0.0001 S
	DHF Vs DSS	26.17	p=0.07 NS
HDL	DF Vs DHF	1.92	p=0.757 NS
	DF Vs DSS	11.00	p=0.003 S
	DHF Vs DSS	9.08	p=0.038 S
LDL	DF Vs DHF	13.70	p=0.004 S
	DF Vs DSS	16.34	P=0.012 S
	DHF Vs DSS	2.86	p=0.167 NS
Cholesterol	DF Vs DHF	16.10	p=0.005 S
	DF Vs DSS	38.80	p<0.0001 S
	DHF Vs DSS	22.70	p=0.003 S

Table 5: Association between TG (mg/dl) and dengue disease category (DF vs DHS+DSS) among the patients.

Dengue Disease category	TG (mg/dl)		Total	Chi-square value	p-value
	≤150	>150			
DF	01(16.7%)	29(65.9%)	30 (60.0%)	5.33	P=0.021 S
DHS+DSS	05(83.3%)	15(34.1%)	20(40.0%)		
Total	06 (100%)	44(100%)	50(100%)		

[odds Ratio: 9.66]

Table 6: Logistic regression model with R-values for prediction of dengue disease category.

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.872[a]	0.760	0.738	0.389
a. Predictors: (Constant), cholesterol, HDL, LDL, triglycerides				

Table 7: Logistic regression model with coefficients.

	B	Std. Error	p-value
(Constant)	5.665	0.355	p<0.0001
Triglycerides	-0.009	0.002	p<0.0001
HDL	-0.011	0.007	p=0.126
LDL	-0.009	0.005	p=0.043
Cholesterol	-0.014	0.004	p<0.0001

Prediction of dengue disease category

Dengue disease category (DF, DHS and DSS) among the patients as a dependent variables and lipids as independent (predictor) variables in patients. Overall the combine lipids were significantly predicting dengue disease category (DF, DHS and DSS). Lipids (Triglycerides, LDL and Cholesterol) among the patients significantly predict Dengue Disease category (DF, DHS and DSS). Whereas independently HDL among the patients not significantly predict dengue disease category (DF, DHS and DSS). [Table 6 and Table 7].

Hospital stay [in days] in dengue disease category

Severe Dengue [DHF and DSS] required larger hospital stay in days as compared to DF patients.

Table 8: Comparison of mean hospital stay [In Days] in dengue disease category.

Dengue Disease category	Mean	SD	F-value	p-value
DF	6.17	1.392	8.82	P=0.001 S
DHF	7.08	1.24		
DSS	8.25	0.897		
Total	6.72	1.48		

There was statistically significant difference of hospital stay in dengue disease category (DF, DHS and DSS). [Table 8]. There was negative correlation between Triglycerides level and Hospital Stay. This relation was found to be statistically significant [p=0.006]. Also, there was negative correlation between HDL level and Hospital

Stay. This relation was found to be statistically significant [p=0.016].

The negative correlation was noted between LDL level and hospital Stay. Also, negative correlation was noted between cholesterol level and hospital stay. This relation was found to be not statistically significant [Table 9].

Table 9: Correlation between hospital stay in days and lipid profile.

Correlation	r- value	p value
Triglycerides Vs hospital stay	-0.385	p=0.006 S
HDL Vs hospital stay	-0.340	p=0.016 S
LDL Vs hospital stay	-0.210	p=0.143 NS
Cholesterol Vs hospital stay	-0.212	p=0.140 NS

Correlation between platelet count and lipid profile

There was positive correlation between Triglycerides level and platelet count. This relation was found not statistically significant [p=0.619]. Also, there was positive correlation between HDL level, LDL level and platelet count. This relation was found to be not significant.

The positive correlation was noted between cholesterol level and platelet count. This relation was found to be statistically significant [p=0.041] [Table 10].

DISCUSSION

In present study, out of 50 patients, 35(70.0%) were male and 15(30.0%) were female. The incidence of male was more as compared to female. The male and female ratio was 2.33:1.00. Similar findings were noted by Jyoti Chandrashekar Suvarna that the male predominance was more as compared to female (M: F, 2.3:1).[17] Understanding male-female differences in infection rates and severity of disease is important for public health control program.

In present study, 30(60.0%) patients were from dengue fever, 12(24.0%) and 8(16.0%) were occurred in dengue disease category of dengue hemorrhagic fever and dengue shock syndrome respectively. Whereas contrast findings was noted by Jyoti Chandrashekar Suvarna reported that 18(36%) patients were DF, 19(38%) DHF and 13(26%) DSS and also Sidrah Lodhi Out of 100l patients, 63(63%) developed dengue fever (DF) and 37(37%) developed dengue hemorrhagic fever.[17-19]

Shashwati Nema also noted that, the proportion of males was observed to be higher than females giving male: female ratio (M: F) ratio 1:0.76.[20] Another three independent studies from epidemics in India done by Ray, Agarwal and Wali found nearly twice the number of male patients infected with dengue compared to females M:F being 1:0.57, 1.9:1 and 2.5:1 respectively.[21-23] Male predominance may be attributed to their more outdoor exposure to transmitting agent. An analytical study was conducted in Singapore found that predominance of male cases was likely due to greater male exposures to dengue carrying mosquitoes during daytime hours either at the work place or while travelling to and from work.[24] However, Yew did not find movement history as a contributing factor for male predominance and suggested male-female differences in the use of health services.[24,25] It has been established earlier that many Asian countries lower disease incidence in women may be a statistical artefact related to lower reporting and care seeking for women.

In present study, 30(60.0%) patients were from dengue fever, 12(24.0%) and 8(16.0%) were occurred in dengue disease category of dengue hemorrhagic fever and dengue shock syndrome respectively. Whereas contrast findings was noted by Jyoti Chandrashekar Suvarna reported that 18(36%) patients were DF, 19(38%) DHF and 13(26%) DSS and also Sidrah Lodhi Out of 100l patients, 63(63%) developed dengue fever (DF) and 37(37%) developed dengue hemorrhagic fever.[17,18]

All the patient's complaint fever, 14(28.0%) and 11(22.0%) patients were complaining abdominal pain and rash respectively. Only 03(6.0%) of patients complain black colour stool. Abm Shahidul Alam study conducted in Bangaladesh 63% of children complained of fever >5 days with continued type of fever being predominant (75.9%). About 60% of patients had abdominal pain, 57% vomiting, 46.3% myalgia, 31.5% headache, 18.5% arthalgia, 14.8% retro-orbital pain, 9.3% loose stool and 3.7% runny nose/cough.[7]

There was statistically significant difference between in mean triglycerides and dengue disease category [p<0.0001]. The mean triglycerides levels were less in DSS and DHF as compared to DF. Same findings were noted in in other lipid profile i.e. HDL, LDL and cholesterol levels in Dengue disease category [DF, DHF and DSS]. The mean difference of Triglycerides level of DF and DHF was 45.56 this difference was statistically significant (p<0.001) and mean difference of triglycerides level of DF and DSS was 74.17 this difference was statistically significant (p<0.0001). The mean difference of Triglycerides level of DHF and DSS was 26.17 and difference was not statistically significant (p=0.070). The mean difference of HDL level of DF and DHF was 1.92 and difference was not statistically significant (p=0.757). Whereas in LDL, the mean difference of LDL level of DHF and DSS was 2.86 and difference was not statistically significant (p=0.167).

Similar findings were noted by Jyoti Chandrashekar Suvarna the mean TC difference for DF and DHF was significant with p value of 0.001.[17] Also the decreased lipids were noted in sever dengue (DHF and DSS) as compared to DF. Also, Ray demonstrated very low plasma cholesterol levels in DSS compared with DHF

group.[26] Whereas contrast findings noted by Villar-Centeno LA that differences in total serum cholesterol levels by dengue severity using basic statistical tests, they did not find statistically significant associations between lower total cholesterol and severe dengue using multivariable models.[27]

There was statistically significant association between TG (mg/dl) level and dengue disease category (DF vs DHS+DSS) among the patients (p<0.021). The Odds of having DSS were times 9.66 more if TG<150 mg⁄dl, then when TG>150 mg⁄dl. Whereas in a study conducted by Suvarna Jyoti Chandrashekar, triglycerides <150 mg/dl were estimated to increase the odds of DSS by 41%, although this association was not significant.[17]

Dengue disease category (DF, DHS and DSS) among the patients as a dependent variables and lipids as independent (predictor) variables in patients. Overall the combine lipids were significantly predicting dengue disease category (DF, DHS and DSS). Lipids (Triglycerides, LDL and Cholesterol) among the patients significantly predict dengue disease category (DF, DHS and DSS). Whereas independently HDL among the patients not significantly predict Dengue Disease category (DF, DHS and DSS).

Villar-Centeno and Dunham conducted their studies on biochemical markers and lipid profile to determine disease severity.[17,27] All these workers reported that serum TC is lower in DHF when compared to DF and among DHF patients, those presenting in DHF III and IV have significantly lower levels.

Biswas HH constructed multivariable models to examine the effect of cholesterol level at presentation on subsequent risk of development of severe dengue as defined by the three classification schemes.[19] Using the WHO 1997 disease severity classification, found that for each 10 mg/dl decrease in total serum cholesterol and LDL-C at presentation, risk of development of DHF/DSS increased by 9% (95% CI: 0-19%) and 12% (95% CI: 0-26%), respectively. A 10 mg/dl decrease in HDL-C at presentation was not significantly associated with risk of development of DHF/DSS. We also examined the effect of total serum cholesterol, LDL-C and HDL-C at presentation on risk of development of severe dengue as defined by the WHO 2009 classification and standardized intervention categories.

van Gorp found lower serum cholesterol, HDL, LDL levels and higher serum TG levels in severest dengue disease and suggested that these levels can be used as prognostic markers to predict clinical outcome.[8]

Sever dengue [DHF and DSS] required larger hospital stay in days as compared to DF patients.

There was statistically significant difference of hospital stay in dengue disease category (DF, DHS and DSS).

There was negative correlation between Triglycerides level and Hospital Stay. This relation was found to be statistically significant [p=0.006]. Also, there was negative correlation between HDL level and hospital Stay. This relation was found to be statistically significant [p=0.016].

The negative correlation was noted between LDL level and hospital stay. Also, negative correlation was noted between cholesterol level and hospital stay. This relation was found to be not statistically significant. Similar negative relationship was noted between lipids and hospital stay by Dunham.[17]

CONCLUSION

From present study conclude that changes in serum lipid profile accompany dengue infection and may guide us in therapy and estimation of severity of dengue or Dengue disease category. Lipid components such as triglycerides LDL, HDL and cholesterol were decreased in dengue infection patients, But in severely ill dengue patients [Dengue haemorrhagic fever and dengue shock syndrome] lipid levels were significantly low as compared to dengue fever patients.

There was statistically significant association between TG (mg/dl) level and dengue disease category (DF vs DHS+DSS) among the patients. Overall the combine lipids were significantly predicting dengue disease category (DF, DHS and DSS). Serum lipids (Triglycerides, LDL and Cholesterol) among the patients significantly predict Dengue Disease category (DF, DHS and DSS).

Reduced Serum Lipid profile can be used as a cost-effective laboratory investigation prompting a high suspicion of severe dengue infection especially in resource poor setting where serological tests may not be available. High index of suspicion of DHF and DSS should be maintained in all patients irrespective of gender.

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REFERENCES

1. World Health Organization. Dengue and Severe Dengue Fact Sheet. Updated April 2016. Available at: http://www.who.int/mediacentre/factsheets/fs117/en/. Accessed on 15th April 2016.
2. World Health Organization, Special Programme for Research, Training in Tropical Diseases, World Health Organization. Department of Control of Neglected Tropical Diseases, World Health Organization. Epidemic, Pandemic Alert. Dengue: guidelines for diagnosis, treatment, prevention and control. World Health Organization; 2009.
3. John DV, Lin YS, Perng GC. Biomarkers of severe dengue disease–a review. J Bio Sci. 2015 Dec 1;22(1):83.
4. Green S, Rothman A. Immunopathological mechanisms in dengue and dengue haemorrhagic fever. Curr Opin Infe Dis. 2006 Oct 1;19(5):429-36.
5. Al-Muhandis N, Hunter PR. The value of educational messages embedded in a community-based approach to combat dengue fever: a systematic review and meta regression analysis. PLoS Neglec Trop Dis. 2011 Aug 23;5(8):e1278.
6. Rauchhaus M, Coats AJ, Anker SD. The endotoxin-lipoprotein hypothesis. Lancet. 2000 Sep 9;356(9233):930-3.
7. Sharma S, Sharma SK, Mohan A, Wadhwa J, Dar L, Thakur S, et al. Clinical profile of dengue hemorrhagic fever in adults during 1996 outbreak in Delhi, India. Dengue Bull. 1998;22:20-30.
8. Bhattacharjee B, Bhattacharya S, Majumdar D, Chakraborty S, Sardar B et al. An Observational Study on Clinical, Epidemiological and Laboratory Profile in Patients of Dengue Fever Admitted to a Tertiary Care Hospital in Kolkata, West Bengal, India in the Year 2016. J Microbiol Exp. 2017:5(5):00161.
9. van Gorp EC, Suharti C, Mairuhu AT, Dolmans WM, van der Ven J, Demacker PN, et al. Changes in the plasma lipid profile as a potential predictor of clinical outcome in dengue hemorrhagic fever. Clin Inf Dis. 2002 Apr 15;34(8):1150-3.
10. Souza LJ, Nogueira RM, Soares LC, Soares CE, Ribas BF, Alves FP, et al. The impact of dengue on liver function as evaluated by aminotransferase levels. Bra J Inf Dis. 2007 Aug;11(4):407-10.
11. Laoprasopwattana K, Tangcheewawatthanakul C, Tunyapanit W, Sangthong R. Is zinc concentration in toxic phase plasma related to dengue severity and level of transaminases?. PLoS Neg Trop Dis. 2013 Jun 20;7(6):e2287.
12. Koraka P, Lim YP, Shin MD, Setiati TE, Mairuhu AT, van Gorp EC, et al. Plasma levels of inter-α inhibitor proteins in children with acute dengue virus infection. PLoS One. 2010 Apr 6;5(4):e9967.
13. Chaturvedi UC, Nagar R. Nitric oxide in dengue and dengue haemorrhagic fever: necessity or nuisance?. FEMS Immunol Med Microbiol. 2009 Jun 1;56(1):9-24.
14. Valero N, Espina LM, Añez G, Torres E, Mosquera JA. increased level of serum nitric oxide in patients with dengue. Ame J Trop Med Hyg. 2002 Jun 1;66(6):762-4.
15. Hober D, Poli L, Roblin B, Gestas P, Chungue E, Granic G, et al. Serum levels of tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and interleukin-1β (IL-1β) in dengue-infected patients. Ame J Trop Med Hyg. 1993 Mar 1;48(3):324-31.
16. van Gorp EC, Suharti C, Mairuhu AT, Dolmans WM, van der Ven J, Demacker PN, et al. Changes in the plasma lipid profile as a potential predictor of clinical outcome in dengue hemorrhagic fever. Clin Inf Dis. 2002 Apr 15;34(8):1150-3.
17. Dunham C, Fealk MH, Sever WE. Following severe injury, hypocholesterolemia improves with convalescence but persists with organ failure or onset of infection. Crit Care. 2003 Dec;7(6):R145.
18. Cui L, Lee YH, Kumar Y, Xu F, Lu K, Ooi EE, et al. Serum metabolome and lipidome changes in adult patients with primary dengue infection. PLoS neg Trop Dis. 2013 Aug 15;7(8):e2373.
19. Sidrah Lodhi, Quratul Ain Tahira, Sajid Abaidullah :Hypocholesterolemia As A Predictor Of Disease Severity In Dengue Fever, annal. 2014, 20 (4), 335-40.
20. Kumar NS, Kalaivanam KN, Ramadas D. Hepatic Proteins & Protein Oxidation-Role in Dengue Fever. Int J Biotechnol Bio. 2016;12(2):161-5.
21. Nema S, Deol A, Tripathi K, Ramnani VK. Seroepidemiology and Gender Related Differences in Laboratory Characteristics of Dengue Virus Infection: A Hospital Based Study, Bhopal. IOSR J Dental Medi Sci. 2017;16(1):95-9.
22. Ray G, Kumar V, Kapoor AK, Dutta AK, Batra S. Status of antioxidants and other biochemical abnormalities in children with dengue fever. J Trop Pediatr. 1999 Feb 1;45(1):4-7.
23. Agarwal R, Kapoor S, Nagar R, Misra A, Tandon R, Mathur A, et al. A clinical study of the patients with dengue hemorrhagic fever during the epidemic of 1996 at Lucknow, India. Southeast Asian J Trop Med Pub Health. 1999 Dec;30(4):735-40.
24. Wali JP, Biswas A, Handa R, Aggarwal P, Wig N, Dwivedi SN. Dengue haemorrhagic fever in adults: a prospective study of 110 cases. Trop Doctor. 1999 Jan;29(1):27-30.
25. Eong OE. Changing pattern of dengue transmission in Singapore. Dengue Bulletin, 2001, 25:40-44. Available at: http://apps.searo.who.int/PDOS_DCS/B0223.pdf. Accessed on 2nd February 2001.
26. Yew YW, Ye T, Ang LW, Ng LC, Yap G, James L, et al. Seroepidemiology of dengue virus infection

among adults in Singapore. Ann Acad Med Singapore. 2009 Aug 1;38(8):667-75.
27. Ray G, Kumar V, Kapoor AK, Dutta AK, Batra S. Status of antioxidants and other biochemical abnormalities in children with dengue fever. J Trop Pediatr. 1999 Feb 1;45(1):4-7.

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