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Research Article

BIOCHEMICAL STUDY OF CERTAIN ENZYMES IN DENGUE FEVER PATIENTS

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ABSTRACT

Objective: The main objective of the present study is to correlate the effect of certain enzymes in diagnosis of dengue fever (DF) and impact of these elevated/decreased blood levels of enzymes on patients of DF.

Methods: The study was carried out on 30 patients suspected to be suffering from DF. Blood sample was collected and tested for various parameters such as protein (albumin), lactate dehydrogenase (LDH), creatinine kinase (CK), C-reactive protein (CRP), acid phosphatase, alkaline phosphatase, serum glutamic oxaloacetic transaminase (SGOT), and serum glutamic pyruvic transaminase (SGPT).

Results: Serum enzymes such as LDH and CK were found to be elevated to be a good marker of muscle damage and progression of diseases. CRP as a marker of inflammation was also found to be elevated. Enzymes like acid phosphatase increased abruptly while alkaline phosphatase was irregular. Liver enzymes SGOT and SGPT activity were also enhanced.

Conclusion: Increased level of transaminases can be reflective of the formation of various amino acids for the synthesis of new protein and for channeling of glutamate and aspartate along with glycine for the synthesis of purine and pyrimidine nucleotides.

Keywords: Dengue, Liver enzymes, Serum glutamate oxaloacetate transaminase, Serum glutamate pyruvate transaminase, Lactate dehydrogenase, Creatine phosphokinase, Alkaline phosphatase, Acid phosphatase.

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INTRODUCTION

Dengue virus is a positive-strand RNA virus of *Flaviviridae* family with four distinct serotypes (DV1-4). It is transmitted to humans by several species of the female *Aedes* mosquitoes. Dengue virus is also a major cause of morbidity throughout the subtropical and tropical regions of the world [1]. Clinical spectrum illness is produced by the infection of dengue virus that extends to an asymptomatic or mild febrile illness to classic dengue fever (DF) to the most severe dengue commonly referred to as dengue hemorrhagic fever (DHF). Studies based on population indicate that asymptomatic infections are mainly the outcomes of dengue virus exposure. However, the occurrence of DHF is commonly associated with high morbidity and mortality [2].

The global prevalence of dengue in recent decades has grown dramatically. This disease is now endemic in more than 100 developed and underdeveloped countries of Africa, America, the Eastern Mediterranean, the Southeast Asia, and the Western Pacific, affecting more than 2.5 billion people. Dengue is believed to infect around 50–100 million people every year worldwide. About half a million life-threatening infections require hospitalization resulting in death of approximately 12,500–25,000 patients [3]. Although dengue is globally distributed among the WHO regions, Southeast Asia and Western Pacific regions cover nearly 75% of the current global disease burden [4]. At present, countries of Southeast Asia as India, Sri Lanka, and Thailand are experiencing an upsurge in dengue reported cases. Major symptoms include fever, headache, muscle and joint pains, and a characteristic skin rash to the extent similar to measles. In some cases, the disease develops into the life-threatening severe DF commonly known as DHF, resulting in bleeding, low levels of blood platelets, and blood plasma leakage. The disease can also develop into dengue shock syndrome, where dangerously low-level blood pressure is observed.

A person can be suffered from DF due to the numerous types of viruses that cause fever. If somebody is infected second time and fells ill, the risk of developing a harsher form of the disease, such as DHF, increases (particularly in children). This is somewhat unusual because, generally, the previous exposure to a virus causes the body to carry antibodies that help to fight off the virus more easily.

Preliminary laboratory diagnosis of dengue virus infection is essential which is routinely carried out by serological test. After infection, anti-dengue IgM antibodies appear within 3 days and remain in blood circulation for 30–60 days. IgG anti-dengue antibodies are seen after a week, go to peak after 2–3 weeks, and remain in blood circulation lifelong. Since no biochemical markers to predict such adverse outcomes are available, so this study was undertaken to ascertain whether C-reactive protein (CRP) could predict an adverse outcome.

A clinical and experimental observation suggests that liver involvement occurs during dengue infections. Clinical evidence comprises hepatomegaly and increased serum liver enzymes. Since liver involvement is more pronounced in the severe infection forms, so liver enzymes were determined. Deliberating the fact that, there are muscle ache and skin rashes, it is speculated that higher level serum enzymes such as lactate dehydrogenase (LDH) and creatinine kinase (CK) would work as good marker of muscle damage and advancement of the disease. Therefore, the present study was planned to establish biological parameters as biochemical marker of dengue.

METHODS

The present research work was carried out on 30 patients who were suspected to be suffering from DF, as they visited at outdoor in the medicine department of Pacific Institute of Medical Sciences (PIMS) Hospital, Umarda, Udaipur. Another batch of 30 normal healthy individuals (medical executive check-up persons) visited PIMS Medical College and Hospital, Umarda, Udaipur, for the estimation of serum parameters.

Table 1: Comparison of biochemical parameters in control and dengue patients

Parameters	Control, Mean±SD	Patients, Mean±SD	Control range	Patients range
Protein albumin (g/dl)	3.02±0.23	4.04±0.32	2.03–5.0	3.5–5.6
SGOT (U/L)	14±1.05	65±22	10.00–18	10–200
SGPT (U/L)	16±1.11	45±23	10.00–9	13–300
LDH (U/L)	138±43.02	367±59	127–300	130–1480
CPK (U/L)	24.11±9.03	117±69	4.0–24	15–1900
CRP (mg/dl)	1.03±0.1	2.5±1.5	0.67–1.23	0.2–9.0
Alkaline phosphatase (U/L)	47.79±5.73	116±67	20.0–50.8	30–270
Acid phosphatase (U/L)	3.45±0.45	5.74±0.42	2.03–4.00	4.5–8.90

Sample size for control as well as patients was 30. LDH: Lactate dehydrogenase, CK: Creatinine kinase, CRP: C-reactive protein, SGOT: Serum glutamic oxaloacetic transaminase, SGPT: Serum glutamic pyruvic transaminase, CPK: Creatine phosphokinase

Blood samples were collected and quantified for various parameters such as:

- Protein (albumin)
- LDH
- CK
- CRP
- Acid phosphatase
- Alkaline phosphatase
- Serum glutamic oxaloacetic transaminase and serum glutamic pyruvic transaminase.

RESULTS

Acid phosphatase enzyme in the serum was higher and showed the activity of 5.74 IU/L. Elevated liver enzymes were frequently seen in patients. In the muscle, creatine phosphokinase (CPK) enzyme content increased on the 4th and 5th days and then diminished on the 6th day. The increase was 4 times as compared to the control batch. Albuminemia higher than 4g/dl was observed. Our results showed about 12-fold increases in levels of aspartate aminotransferase (AST) and alanine transaminase (ALT). Increase in transaminases enzyme can be indicative of the formation of various amino acids for new protein synthesis and for channeling of glutamate and aspartate along with glycine for the synthesis of purine and pyrimidine. Liver damage which is a frequent problem in dengue can also be associated with higher levels of LDH. The LDH (367 IU/L in patients) level was increased to 2.65 times than control which was 138 IU/L.

DISCUSSION

Observation has revealed that acid phosphatase in the serum was higher and showed the activity of 5.74 IU/L, which correlates with the results of studies carried out by Yam [5]. The reason for increased activity of acid phosphatase in DF is their release from osteoclast, which is in accordance with the clinical observation of severe bone pain in many patients associated with this disease [6]. Irregular increase in alkaline phosphatase was observed which was also seen by Jagadishkumar *et al.* [7].

In the present study, the CPK content of the muscle elevated 4 times on the 4th and 5th days and then diminished on the 6th day and albuminemia <4 g/dl was associated with a lower risk of DHF.

It is probable that high values of albuminemia may reflect the integrity of the vascular endothelium; however, albumin level >4 g/dl can be seen as an early indicator of vascular permeability alteration [8,9].

Experiments and clinical observations reflect that liver involvement occurs during dengue infections. Clinical manifestations include hepatomegaly and an increase in serum liver enzymes, with liver involvement that is more pronounced in severe forms of infections. Dengue viral antigen has been discovered within hepatocytes. The virus seems to be able to replicate in hepatocytes and Kupffer cells and also the dysregulated host immune response may play a major causative role in liver damage. Aminotransferase levels are supportive in predicting the occurrence of hepatic dysfunction and spontaneous bleeding [10]. The results of the study revealed about 12-fold increases in AST and ALT levels. Increase in transaminases can be reflective of the formation of various amino acids for new protein synthesis and for channeling of glutamate and aspartate along with glycine for the synthesis of purine and pyrimidine. Kuo *et al*. have also reported abnormal levels of AST and ALT [11,12]. Liver damage which is a frequent problem in dengue can also be associated with increased levels of LDH.

CONCLUSION

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AUTHORS' CONTRIBUTIONS

The author declares that all the named authors have contributed equally to this article.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

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