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Original Research Article

Study of serum malondialdehyde and uric acid levels in patients with malaria

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ABSTRACT

Background: Malaria is parasitic disease of humans caused by parasitic protozoan and genus plasmodium, widely present in tropical region. In the blood, the parasite travel to the liver to mature and reproduce. Oxidative stress is generated through the invasion of malarial parasites in human system. Malondialdehyde is a highly reactive compound is assayed in vivo as a biomarker of oxidative stress. Uric acid contributes to the pathology of human malaria by stimulating the production of cytokines from immune system.

Aim: To estimate serum MDA & serum uric acid levels in patients with malarial infection and compare same with healthy individuals.

Settings and Design: This is a cross-sectional observational study, cases and controls were selected using random sampling method, attending hospital OPD.

Materials and Methods: Study includes 50 laboratory diagnosed cases of malaria patients with equal age and sex matched controls. MDA was estimated using MDA - thiobarbituric acid method, uric acid was estimated by phosphotungstic acid method. Standardization of both the methods was carried out prior to experiment.

Results: There is generalized increase in serum MDA and uric acid levels in cases as compared to the control group.

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1. Introduction

Malaria is parasitic disease of humans and other animals caused by parasitic protozoan and genus plasmodium, widely present in tropical region. The disease is transmitted through bite of an infected female anopheles mosquito, which introduces the organism from its saliva in to a person's circulatory system. In the blood, the parasite travel to the liver to mature and reproduce. Oxidative stress is generated through the invasion of malarial parasites in human system. The malaria parasite itself generates large

quantities of reactive oxygen species and also through its interaction with phagocytes. The oxidantstress originates due to destruction of red cells which cause imbalance between generation of reactive oxygen species (R O S) and the antioxidant defense system.¹ Oxidative stress seems to play a significant role in many human diseases and considered to be both the cause and consequence of some diseases.²

Malondialdehyde is a highly reactive compound and is generated from ROS, and is assayed in vivo as a biomarker of oxidative stress. In malaria patients, there is significant decrease in antioxidant enzymes superoxide dismutase

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(SOD), catalase (CAT) and increase in Malondialdehyde (MDA).³ Uric acid (UA) is the degradation product of purine metabolism. Uric acid is also known as modulator of immune response.⁴ Uric acid contributes to the pathology of human malaria by stimulating the production of cytokines from immune system. Hence measuring uric acid levels is useful tool to assess severity of malaria.⁵ Renal dysfunction that is observed during severe malaria infections contributes to the increase uric acid levels in plasma. The malaria parasite itself generates large quantities of reactive oxygen species and also through its interaction with phagocytes. The oxidative stress originates with destruction of red cells, which cause imbalance between the generation of reactive oxygen species and the antioxidant defense system.¹

2. Aim

To estimate serum MDA & serum uric acid levels in patients with malarial infection and compare same with healthy controls.

3. Materials and Methods

The study includes 50 laboratory diagnosed cases of malaria patients with equal age and sex matched control attending hospital OPD. This is cross sectional observational study, cases and controls were selected using random sampling method.

Sample size was decided on the basis of formula:⁶

$$n = 4pq/l^2$$

where l is permissible error in the estimation of new statistics, p is positive character, and q is 1 – p. Prevalence to estimate sample size found from previous studies of own institute, and National journals.

MDA was estimated using MDA - thiobarbituric acid method,⁷ uric acid is estimated by phosphotungstic acid method.⁸ Standardization of both the methods was carried out prior to experiment. All due ethical considerations were taken during the conduct of the study

The Institutional Ethics Committee has reviewed and approved the protocols (sr. number PG/EC/46/09).

3.1. Statistics

Two study groups were compared by unpaired t tests. Graph pad version 9.2.0 online free software is used for statistics. P value ≤ 0.05 is considered statistically significant.

4. Results

There is generalized increase in serum MDA (Table 1) and uric acid levels (Table 2) in cases as compared to control group. P value is highly significant (0.001) for serum MDA and significant (0.02) for serum uric acid. This suggests that there is significant increase (≤ 0.05) in MDA levels and serum uric acid levels in cases as compared to controls.

Table 1: Serum levels of malondialdehyde (mg %) incases and controls

MDA levels	Cases (n= 50)	Controls (n= 50)
Range	482.25 – 789.21	180.32 – 495.67
Mean	582.58	192.27
Standard deviation		± 14.78
Standard error		± 4.39
p value (unpaired t Test)		≤ 0.0001

The mean level of MDA (malondialdehyde) in cases was 582.58 mg/dl as compared to controls 192.27 27 mg/dl which is statistically significant (Table 1).

Table 2: Serum levels of uric acid (mg %) in patients and controls

Uric acid levels	Cases (n= 50)	Controls (n= 50)
Range	6.92 – 10.23	3.20 - 6.99
Mean	8.19	4.81
Standard deviation		± 1.06
Standard error		± 0.0212
p value (unpaired t Test)		≤ 0.02

The mean level of uric acid in controls is 4.81mg/dl as compared to cases 8.19 mg/dl is also statistically significant (Table 2).

5. Discussion

Increase of serum MDA level may be due to generation of ROS (Reactive Oxygen Species) during hemoglobin consumption by malaria parasites, which in turn enhance the chain reaction of lipid peroxidation releasing H_2O_2 which accelerate lipid peroxidation again. This indicates the lipid peroxidation is increased in malaria as compared to normal healthy controls. Our study findings were similar with the results found other researchers studies like OB Idonije et al.⁹ Mohammed Khalid Rashid et al,¹⁰ Camila Fabbri et al.¹¹ Increased levels of serum uric acid show its involvement in pathogenesis, it helps in activation of immune system and release of cytokines. Similar results of increased uric acid levels were also obtained by Gallego-Delgado J et al,¹² Jamie M et al.¹³

Uric acid levels increase during episodes of uncomplicated malaria and more increase found in severe malaria. Levels of serum uric acid also correlate with malaria parasite density.⁵

Uric acid is emerging as a central inflammatory molecule in malaria. Not only is uric acid found in the precipitated form in infected erythrocytes, but high concentrations of hypoxanthine, a precursor for uric acid, also accumulate in infected erythrocytes.¹⁴

6. Conclusion

There is oxidative stress in malaria due to generation of ROS leads to increase MDA levels. Also there are increased uric acid levels due to inflammation. Hence for good healing and recovery from malaria, we need to take good antioxidants in diet during infection.

7. Source of Funding

None.

8. Conflict of Interest


None

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