



NOTE

Alterations in Serum Biochemical Parameters of Horses with Leptospirosis

S. GUZEL* and M. TANRIVERDI

Department of Biochemistry, Faculty of Veterinary, Medicine, University of Uludag, Gorukle Campus, 16059 Bursa, Turkey

*Corresponding author: Fax: +90 224 2941202; Tel: +90 224 2941270; E-mail: saime@uludag.edu.tr

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In this study, the alterations in serum biochemical parameters of horses with leptospirosis was investigated. For this aim, 8 h with leptospirosis, were determined by the microscopic agglutination test and 8 healthy horses were used as material. The levels of serum glucose, urea, creatinine, uric acid, total cholesterol, high-density lipoprotein (HDL), triglyceride, total protein, albumin, globulin, aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), creatinine kinase (CK), sodium, potassium, chloride, calcium, phosphorus, magnesium were evaluated in leptospirosis cases and healthy horses. Although we found significant decreases in levels of glucose ($p < 0.01$), uric acid ($p < 0.01$), HDL cholesterol ($p < 0.05$), ALP ($p < 0.01$), Cl ($p < 0.01$), Ca ($p < 0.05$), P ($p < 0.001$) in horses with leptospirosis, level of urea ($p < 0.05$) in horses with leptospirosis showed significant increases. The results obtained may suggest that these parameters might have taken part in the diagnosis and treatment of horse leptospirosis.

Key Words: Horse, Leptospirosis, Biochemical parameters, Glucose.

Leptospirosis is a zoonotic acute bacterial disease with world-wide distribution. The disease is caused by various serovars of *Leptospira* spp. and is presumed to be the most widespread zoonosis¹. The disease is sustained in nature by maintenance hosts namely infected animals. Human and animals may acquire disease by direct or indirect contact with materials contaminated with excretions of the infected animals such as urine and uterus discharge². Following invasion of the organism the kidney and liver are the major parenchymatous organs affected and cytotoxic factors take part. Renal colonization occurs as the organism replicates and persists in renal tubular epithelial cells resulting in varying degree of interstitial nephritis with inflammatory cells surrounding the tubules leading to renal failure³. Similarly, liver is also invaded by the bacteria resulting in liver disorganisation and hepatocyte apoptosis⁴ and hepatic central-lobular necrosis⁵.

Leptospirosis in horses is most commonly associated with uveitis (moon blindness) or abortions. The disease is typically seen as a self-limiting mild fever with anorexia, although in severe forms hemolysis and vasculitis can result in petechial hemorrhages on mucosal surfaces, hemoglobinuria, anemia, icterus, conjunctival suffusion, depression and weakness. Renal failure has been documented in foals^{6,7}. Leptospirosis is a growing problem for horse owners because there's no vaccine specifically for horses. To prevent problems, horse owners are advised to keep an eye out for possible signs of leptospirosis

and to take precautions to reduce the risks of infection⁶. Furthermore, there is a lack of studies regarding biochemical changes in horses with Leptospirosis, what can be useful to a better understanding of the possible signs and systemic effects of the infection. Pinna *et al.*⁸ studied horses with Leptospirosis and especially concentrated on the parameters of the enzymes. However there are apparently no reports regarding other biochemical parameters such as triglyceride, total protein, albumin, globulin, Na, K, Cl in horses with leptospirosis.

The study was performed in 8 horses suffering from leptospirosis which were detected by the microscopic agglutination test⁹ and 8 clinically healthy horses. All animals were from Bursa region of Turkey and were subjected to similar management conditions. Blood samples were collected from all animals *via* jugular vein into Vacutainer blood collection tubes and were transported on ice chest to the laboratory for analysis immediately. Sera were collected by centrifugation at 3000 g for 10 min at room temperature. Serum glucose, urea, creatinine, uric acid, total cholesterol, HDL cholesterol, triglyceride, total protein, albumin, globulin, AST, ALP, LDH, CK, Na, K, Cl, Ca, P, Mg levels were measured using autoanalyzer (Helena Technicon RA-1000 TM System) and accompanying kits.

Statistical analysis was performed using the SPSS 17.00 statistical program. Normal distribution of the data was determined using Anderson-Darling Normality test. Duncan-

ANOVA test was used to compare the parameters between the groups. For all parameters p -values < 0.05 were considered significant. Data are presented as means \pm SD.

In the healthy and leptospirosis groups, the average levels of serum glucose, urea, creatinine, uric acid, total cholesterol, HDL cholesterol, triglyceride, total protein, albumin, globulin, AST, ALP, LDH, CK, Na, K, Cl, Ca, P, Mg with the statistical significance of standard deviations and the differences between the groups, are given in Table-1. There was a statistically significant decrease in serum level of glucose ($p < 0.01$) in horses with leptospirosis according to the values of the healthy group. However glucose concentration is reported to increase in human leptospirosis with pancreatitis involvement¹⁰ and cattle leptospirosis¹¹.

TABLE-1
CHANGES IN BIOCHEMICAL PARAMETERS IN HORSES WITH LEPTOSPIROSIS (n = 8) ($p < 0.05$) ($^{**}p < 0.01$) ($^{***}p < 0.001$)

Biochemical parameters	Groups	
	Healthy $\bar{x} \pm$ SD	Leptospirosis $\bar{x} \pm$ SD
Glucose (mg/dl)	78.37 \pm 7.45	51.62 \pm 4.98 ^{**}
Urea (mg/dl)	25.14 \pm 1.86	33.00 \pm 2.97 [*]
Creatinine (mg/dl)	1.175 \pm 0.04	1.125 \pm 0.06
Uric acid (mg/dl)	0.33 \pm 0.03	0.17 \pm 0.025 ^{**}
Total cholesterol (mg/dl)	103.87 \pm 6.40	87.80 \pm 6.00
HDL cholesterol (mg/dl)	61.75 \pm 3.22	42.50 \pm 6.88 [*]
Triglyceride (mg/dl)	45.62 \pm 3.93	33.00 \pm 8.7
Total protein (g/dl)	6.21 \pm 0.61	6.27 \pm 0.14
Albumin (g/dl)	2.61 \pm 0.15	2.65 \pm 0.06
Globulin (g/dl)	3.6 \pm 0.07	3.7 \pm 0.13
AST (U/l)	210.12 \pm 19.97	187.5 \pm 42.74
ALP (U/l)	334.75 \pm 42.61	193.75 \pm 33.17 ^{**}
LDH (U/l)	312.5 \pm 30.6	230.37 \pm 20.03
CK (U/l)	100.25 \pm 11.01	88.86 \pm 29.52
Na (mEq/l)	139 \pm 0.63	132.75 \pm 2.87
K (mEq/l)	3.92 \pm 0.13	3.51 \pm 0.19
Cl (mEq/l)	100.62 \pm 1.16	92.5 \pm 2.45 ^{**}
Ca (mg/dl)	12.36 \pm 0.28	10.96 \pm 0.53 [*]
P (mg/l)	4.4 \pm 0.38	2.21 \pm 0.20 ^{***}
Mg (mg/dl)	1.93 \pm 0.06	1.76 \pm 0.05

On the contrary, the level of urea in horses with leptospirosis were found to be increased significantly when compared with the healthy group ($p < 0.05$) (Table-1). Begenik *et al.*¹² also found high ure level in human leptospirosis. The serum uric acid level (0.17 \pm 0.025 mg/dl) in horses with leptospirosis was approximately 2-times lower than the level of healthy horses (0.33 \pm 0.03 mg/dl) ($p < 0.01$). We also found a significant decrease in the level of HDL cholesterol in horses with leptospirosis when compared with the healthy group ($p < 0.05$) (Table-1). Similarly Gazi *et al.*¹³ conclude that leptospirosis lowers serum HDL cholesterol level in human and this effect may be mediated by TNF α and IL-1 β . The level of ALP significantly decreased in horses with leptospirosis when compared with the healthy group ($p < 0.01$). We determined a significant decrease in serum Cl ($p < 0.01$), Ca ($p < 0.05$) levels in the horses with leptospirosis when compared with the healthy group (Table-1). Zaragoza *et al.*¹⁴ found normal level of calcium in canine leptospirosis. The average serum concentrations of P in horses with leptospirosis were about 2-fold lower than in

the healthy group ($p < 0.01$) (Table-1) consistent with those of Zaragoza *et al.*¹⁴ in canine leptospirosis.

There were no significant differences regarding creatinine, total cholesterol, triglyceride, total protein, albumin, globulin, AST, LDH, CK, Na, K, Mg between two groups (Table-1). Pinna *et al.*⁸ reported that creatinin level increased from 0.67 mg/dl-1.1 mg/dl to 1.2 mg/dl ($p < 0.05$), AST level decreased from 303 U/l-336 U/l to 317 U/l and LDH level changed from 629 U/l-770 U/l to 763 U/l and ALP level increased from 245 U/l-321 U/l to 350 U/l in horses with leptospirosis. In the present study serum AST, LDH, ALP levels in horses with leptospirosis were lower than that shown by Pinna *et al.*⁸. Serum creatinin level were almost the same with reported by Pinna *et al.*⁸ (1.2 mg/dl) (Table-1). Zaragoza *et al.*¹⁴ reported that four of the 10 dogs with leptospirosis showed decreased concentrations of serum albumin and three of which showed increased concentrations of cholesterol. Begenik *et al.*¹² reported that decreased levels of Na and K and increased level of CK in human leptospirosis.

Conclusion

Leptospirosis is an important infectious disease characterized mainly by trigger fever, uveitis, abortions and even death in horses. Consistent with this several serum biochemical parameters also changes during the disease and these parameters useful for diagnosis of leptospirosis. In this study we determined significant decreases in levels of glucose, uric acid, HDL cholesterol, ALP, Cl, Ca, P and increase level of urea in horses with leptospirosis.

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