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## CHRONIC RENAL INSUFFICIENCY IN HORSES AND RUMINANTS – CLINICAL AND LABORATORY ANALYSIS REPORTS

**Key words:** *chronic renal failure, horses, ruminants, hematological and biochemical analysis*

Chronic renal failure is a syndrome of progressive loss of renal function that results in loss of urinary concentrating ability, retention of nitrogenous and other metabolic end products, alterations in electrolyte and acid-base status, and dysfunction of several hormone systems. As a result of progressive injury of active nephrons the accumulation of toxic products of metabolism is observed as well as a number of homeostatic disorders concerning the whole body.. In the course of chronic renal insufficiency disturbances in hematopoiesis, secondary hyperparathyroidism, electrolyte and acid-base disbalance. The disease occurs mainly in dogs and cats, rarely in farm animals. In those animals the disease is hardly ever of primary character (ingenious). In this paper the clinical observations and laboratory data reports were presented, concerning the course of chronic renal insufficiency in horses and ruminants.

### 1. Chronic renal insufficiency in horses.

**Tab.1. Results of the hematological examinations**

	Horses reference values	Horse nr 1	Horse nr 2	Horse nr 3
WBC [ $10^9/l$ ]	5 – 12	7,76	15,36	8,27
RBC [ $10^{12}/l$ ]	6 - 12	8,74	11,7	9,42
Hb [g/l]	10 - 18	13,1	18,6	12,6
Ht [%]	28 - 50	36,9	56	49,4
N.band. [%] ( $\times 10^9/l$ )	do 2	2 (0,160)	---	2 (0,170)
PMNL. [%] ( $\times 10^9/l$ )	30 - 65	68 (5,277)	91 (13,980)	80 (6,620)
Eosin. [%] ( $\times 10^9/l$ )	do 11	---	---	---
Basof. [%] ( $\times 10^9/l$ )	do 3	2 (0,155)	---	1 (0,827)
Lymph. [%]	25 - 65	28	9	17

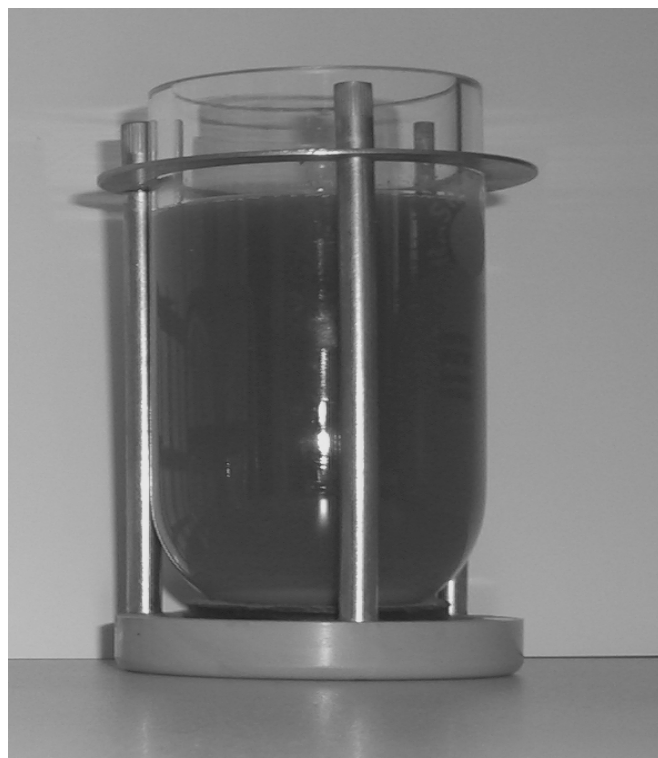
(/x 10 <sup>9</sup> /l)		(2,172)		(1,410)
Monocytes. [%] (/x 10 <sup>9</sup> /l)		---	---	---
Neutrophil / Lymphocyte Ratio	0,8 – 2,8	2,57	10,1	4,87
MCV [fl]	35 – 60	42,2	47,7	52,4
MCH [pg]	13 - 20	14,9	15,9	13,4
MCHC [g/dl]	30 - 42	35,4	33,4	25,6
Thrombocytes [10 <sup>9</sup> /l]	100 - 400	218		264

**Tab.2 .Results of biochemical examinations**

	Horses reference values	Horses nr 1	Horses nr 2	Horses nr 3
Total protein [g/l]	60 – 78	75		65,2
Albumin[g/l]	29 – 59			33,5
Globulin[g/l]	25 – 96			31,7
Albumin/Globulin Ratio	0,8 - 2,8			1,06
Urea [mg/dl]	25 – 45	244	272	58
Creatinine [mg/dl]	1,2 – 1,9	3,55	4,10	3,41
CPK [U/l]				
AST [U/l]	250 – 350	233	2 682	163
GGT [U/l]	7 – 36		126	9
AP [U/l]	84 – 300			286
Glucose [mg/dl]	55 - 110		106,2	109,4
Total bilirubin [mg/dl]	0,5 – 2,0	7,5	4,84	7,78
Total cholesterol [mg/dl]	50 - 108		967	169
Triglicerides [mg/dl]	8,9 – 62,0		921	
Na [mmol/l]	140 - 156	136	129	138
K [ mmol/l]	3,5 – 4,7	4,9	4,4	3,8
Ca <sup>++</sup> [mmol/l]	1,1 – 1,7	2,75	1,48	1,47
Cl [mmol/l]	90,2 – 107,2			108
Total Ca[mg/dl]	9,5 – 11,5	19,5		
Mg [mg/dl]	1,7 – 2,8	3,3	2,19	2,2
P inorganic [mg/dl]	4,0 – 8,0	2,1	7,45	3,9
PH	7,36 – 7,44		7,32	7,44
pCO <sub>2</sub> [mm Hg]	38 – 46		28	35
pO <sub>2</sub> [mm Hg]	92			
HCO <sub>3</sub> [mmol/]	24 – 30		16,6	21,8
BE [mmol/]	od -3 do +3		- 11,3	
LA	12 - 18			20,8
tCO <sub>2</sub> [mmol/l]	24 - 32			22,7
A [0,175 x TP] [mEq/l]	11 - 16			11,4

**Tab. 3. Results of urine examinations**

Properties	Horses nr 1	Horses nr 2	Horses nr 3
Tranclucency	Slightly turbid	turbid	turbid
Specific weight	1,008	1,012	1,022
pH	8,0	6,0	6,5
Protein	+++	+++	+
Blood	-	+++	++
Ketones		+	
Sedyment	Leukocytes 0 – 4 wpw; Erythrocytes fresh 0-1, numerous crystals of calcium oxalate, single squamous epithelia	squamous epithelia 2 wpw ; leukocytes 2 – 8; erythrocytes –in large number ; numerous bacterial flora and numerous calcium oxalate	Leukocytes 2 – 4 wpw; Erythrocytes leached 30 – 50; numerous amorphous phosphates



**Fot.1. Equine urine in chronic renal insufficiency in the course of hyperlipemic syndrome.**

**2. Chronic renal insufficiency in bull and goat.****Tab. 4. Results of hematological examinations**

	Cows reference values	Cow	Goats reference values	Goat
WBC [ $10^9/l$ ]	4 – 10	10,77	5 - 13	46,97
RBC [ $10^{12}/l$ ]	5 - 8	6,89	8 - 18	13,05
Hb [g/l]	8 - 14	8,5	8 - 14	8,9
Ht [%]	27 - 48	25,8	11 - 50	29,4
N.band. [%] (/x $10^9/l$ )	do 2 < 0,12	---	rarely	11 (5,17)
PMNL. [%] (/x $10^9/l$ )	15 – 45 (0,60 – 4,00)	27 (2,91)	30 - 48	83 (38,99)
Eosin. [%] (/x $10^9/l$ )	2 – 20 (< 0,40)	---	1 - 8	-
Basophil. [%] (/x $10^9/l$ )	do 2 (< 0,20)	---	< 1	-
Lymph. [%] (/x $10^9/l$ )	45 – 72 (2,50 – 7,50)	72 (7,75)	45 - 70	6 (2,82)
Monocytes. [%] (/x $10^9/l$ )	2 – 7 (0,025 – 0,84)	1 (0,11)	< 4	-
Neutrophil / Lymphocyte Ratio	0,84 – 0,94	0,39	0,84 – 0,94	15,66
MCV [fl]	40 - 60	37,4	16 - 25	22,6
MCH [pg]	11 - 17	12,1	5,2 - 8	6,8
MCHC [g/dl]	30 - 40	33,1	28 - 42	30,1
Thrombocytes [ $10^9/l$ ]	100 - 800	1 037	200 - 600	90

**Tab. 5. Results of biochemical examinations**

	Cows reference value	Cow	Goats reference value	Goat
Total protein [g/l]	51 – 71	88,2	59 - 78	70,1
Albumin [g/l]	32 - 49	29,85	25 - 44	36,6
Globulin [g/l]	28 - 88	58,35	31 - 71	33,5
Albumin/Globulin Ratio	0,8 – 0,9	0,51		1,09
Urea [mg/dl]	10 - 45	199	28 - 94	630,9
Creatinine [mg/dl]	1,0 – 2,1	5,51	1,1 – 2,2	28,3
CPK [U/l]	56 - 410	124	28 - 130	463
AST [U/l]			66 - 230	196,2
GGT [U/l]				51
AP [U/l]			75 - 228	91
Amylase [U/l]			Do 30	46
Glucose [mg/dl]	40 - 80	85,4	54 - 93	192,2
Total bilirubin [mg/dl]	0,1 – 0,5	0,05	0,1 – 0,9	0,12
Total cholesterol [mg/dl]	70 - 201	66	62 - 108	76
	51 – 71	88,2		

Na [mmol/L]	135 - 156	131		
K [ mmol/L]	3,8 – 5,1	3,6		
Ca <sup>++</sup> [mmol/L]	1,15 – 1,40	1,06		
Ca total [mg/dl]	9,0 – 11,5		9,5 – 11,5	8,30
Mg [mg/dl]	1,8 – 3,2	3,4	1,8 – 3,8	4,22
P [mg/dl]	4,0 – 9,5	3,93	5 - 12	6,0

Results of cows urine examinations:

Colour : blood-red; translucency: turbid; specific weight – 1,012; pH – 8,5; protein (+++); blood (+++); sediment: leukocytes 3 – 6 ; fresh erythrocytes – in large number



**Fot.2. Bovine urine in renal insufficiency**

Clinical observations.

Chronic renal insufficiency in horses is developed for a long time without clinical manifestations. Each additional overload of the organism (mainly pregnancy) leads to clinical manifestations. One of the most characteristic symptoms of renal injury are urinary disturbances and polyuria and polydypsa. Increased thirst (60 liters per day) is the most frequently observed symptom by the owners as well as urinary changes (turbidity, change of color – aquaeous bright, red). Besides, the loss of body weight occurs, in spite of normal appetite. In mare no.1 abnormal appetite was noticed (gnawing at the bark of trees and eating rotten wood). The skin was covered with dry matt hair (horse no.1). In the case of another coexisting disease e.g. hyperlipemic syndrome, clear, nonspecific symptoms appear, such as loss of appetite and thirst, glumness. The above mentioned symptoms are the consequence of

multiorganic insufficiency (kidneys, liver) and metabolic disorders. In the course of hyperlipemic syndrome unless the renal insufficiency appears, the prognosis is good. Mares' miscarriage which is observed in the course of hyperlipemic syndrome can be the result of both renal insufficiency and the disturbances of metabolism. Equine renal insufficiency results in lethal outcome in several weeks.

In cows and goats clinical manifestations are usually not observed. In the goat no clinical manifestations were observed until the occurrence of peritonitis. The owner did not notice the changes in the urine (purulent urine) or the changes in urination. The characteristic symptoms are progressive weight loss and urine changes. If another diseases coexists (e.g peritonitis) the symptoms of general intoxication are observed, similar to those in the horse. The goat is not susceptible to treatment. Chronic renal insufficiency itself does not directly lead to lethal outcome of ruminants. Another accompanying disease plus renal insufficiency leads to death.

#### Laboratory data changes

The basis to diagnose is the elevated urea concentration and creatinine concentration in the serum. The highest urea concentration was noted in goat blood (660,9 mg/dl) and in horse nr 2 (274 mg/dl) blood. Also in the goat and horse nr 2 the highest creatinine conc in blood was found (28,3 i 4,10 mg/dl respectively). In no case the disturbances in erythrocytes were observed. The consequence of renal insufficiency are the disturbances in calcium-phosphate metabolism. Unlike in the chronic r.i in dogs and cats, no hyperphosphatemia was found in farm animals. However in two cases lower phosphate concentration was observed. In the bull and goat in the course of renal insufficiency low concentration of total Ca was found. However two horses were normocalcemic and one hypercalcemic, horse no 2 and goat exhibits high level of Mg in serum. In severe stages of r.i. metabolic acidosis was observed.

Urine analysis showed: red colour, pyuria, low specific weight, high degree proteinuria, hematuria, ketones in urea.

#### Conclusions.

- 1.Chronic renal failure (CRF) in ruminants dose not present clear clinical manifestations.
- 2.Equine renal ins leads to lethal outcome during several weeks.
- 3.In the course of CRF in horses and ruminants erythrocyte disorders do not occur.
- 4.Ca,P, Mg metabolism disturbances are not pathognomonic in the course of chronic renal insufficiency.
- 5.In the course of CRF in horses and ruminants urine changes are always observed.

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Стаття надійшла до редакції 24.09.2010