Original Research Article

Haematobiochemical Study in 556 Recumbent Cows Presented to Veterinary College Hospital at Namakkal Tamil Nadu during the Period 2015 to 2019

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A B S T R A C T

Recumbent cow syndrome refers to cows that become recumbent and fail to rise. Five hundred and fifty six cows presented in recumbency to veterinary hospital, Namakkal district of Tamil Nadu during the period June 2015 to May 2019 were analyzed for haematobiochemical changes. There was no significant difference in the haematological values within the recumbent cows having metabolic disorders. However recumbent cows due to abdominal dysfunction, infectious causes, musculoskeletal and nervous disorders had significant leukocytosis with neutrophilia when compared to their respective control means. A significant hypocalcemia, elevated mean creatinine kinase and gamma glutamyl transferase was noticed in all the recumbent cows when compared to their respective mean serum values of control animals.

Introduction

Nonambulatory cows were unable or unwilling to stand and remained recumbent for ≥12 hours. Regardless of cause, an extended period of recumbency initiated secondary damage to the muscles and nerve tissue, causing a condition described as secondary recumbency, which in turn increased the risk of compartmentalization and crushing syndrome. There were many definitions of downer cow syndrome, but it was commonly accepted as being an alert cow unable or unwilling to stand up for 12 hours or more. Other definitions include all nonambulatory cattle (alert or nonalert) unable to stand for any duration of time without assistance. It becomes essential to document the changes in

the haematobiochemical parameters in the recumbent cows to serve as data base for the diagnosis and predication of outcome of the future case. This study was undertaken to study the haematobiochemical changes in the recumbent cows presented to Veterinary Hospital, Veterinary College and Research Institute, Namakkal in Tamil Nadu.

Materials and Methods

Five hundred fifty six recumbent cows that were brought to the Large Animal Medical unit of Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal in recumbency were utilized for the study. They were grouped based on the anamnesis, clinical and diagnostic investigations into Recumbent cow due to Metabolic disorders (n= 186), Recumbent cow due to abdominal dysfunction (n= 132), Recumbent cow due to Infectious causes (n= 42), Recumbent cow due to Intoxication (n= 17) and Recumbent cow due to Musculoskeletal and nervous disorders (n= 179). These were subjected to detailed clinical examination, haemato-biochemistry, radiography, ultrasonography and liver biopsy. Clinical examination of the animal was undertaken as per standard methods. Five millilitres of venous blood was collected in vacutainer tubes containing ethylene diamine tetra acetate (EDTA K_3) as anticoagulant for haematological investigation. Five milliliters of venous blood was collected in vacutainer tubes without anticoagulant taking all precautions for avoiding haemolysis as suggested by Alleman (1990). Calcium, phosphorus, potassium, magnesium, total protein, glucose, gamaglutamyl transaminase (GGT) and creatinine phosphokinase (CK) were estimated using commercially available kits. The animals which were suspected for skeletal involvement were subjected radiograph using Wipro GE 525 DX X ray unit. All the animals under study were

subjected to ultrasonographic examination using Esoate Mylab 40 Vet Ultrasound machine using 2.0 – 3.5 MHz transducer. The data obtained were analysed using statistical analysis and presented.

Results and Discussion

Haematology

The mean haematological values of apparently healthy and recumbent cows are presented in Table 1 and 3.

The mean haemoglobin, packed cell volume, red blood cell, white blood cell, neutrophil, lymphocyte, monocyte and eosinophil counts in apparently healthy cows were 12.29 ± 0.38 g/dl, 37.57 ± 1.10 %, 5.94 ± 0.06 x 10^6/cumm, 6.50 ± 0.21 x 10^3/cumm, 38.29 ± 01.46 %, 60.25 ± 5.38 %, 1.03 ± 0.27 % and 0.40 ± 0.15 % respectively. The results of the mean haemoglobin, packed cell volume, erythrocyte, leucocyte and differential counts observed in apparently healthy animals were within the normal range reported for the health cows.

Recumbent cows

There was no significant difference in the haematological values within the recumbent cows having metabolic disorders. However recumbent cows with abdominal dysfunction, infectious causes, musculoskeletal and nervous disorders had significant leukocytosis with neutrophilia when compared to their respective control means. Alsaad, 2011 and Kirbas *et al.,* 2015 reported neutrophilic leucocytosis with left shift and elevated levels of serum protein in bovines with traumatic reticuloperitonitis or peritonitis. Khalphallah *et al.,* 2016 recorded increased leukocyte count, serum aspartate aminotransferase and alkaline phosphatase in cattle with intestinal obstruction. Wood opined that marked neutro-

philic leukocytosis observed in all the animals might be due to infection, catecholamine or glucocorticoid response due to stress or inflammation.

Serum Biochemistry

The mean serum biochemical values of apparently healthy and recumbent cows are presented in Table 2 and 4.

The mean total protein, albumin, serum calcium, phosphorus, magnesium, potassium, creatinine kinase and gamma glutamyl transferase in apparently healthy cows were 7.58 ± 0.16 g/dl, 3.90 ± 0.10 g/dl, 9.92 ± 0.54 mg/dL, 6.32 ± 0.22 mg/dL, 2.12 ± 0.15 mg/dL 4.58 ± 0.11 mEq/L, 33.17 ± 17.61 IU/L and 16.22 ± 1.86 IU/L respectively. The mean serum biochemical values of apparently healthy cattle in the present study were within the normal range reported by Kaneko *et al.,* 2009.

A significant hypocalcemia was noticed in all the recumbent cows. Recumbent cows with hypocalcemia and hypophosphatemia had a significantly lower value of mean serum calcium and phosphorus when compared to their respective mean values of control animals. Sharifi *et al.,* 2007 and Jubb and Crough, (1988) opined that typical symptoms of hypophosphataemia occurred when the level of inorganic phosphorus was lower than 2–2.1 mg%. Mature cows fed trace-mineralized salt maintained lower potassium concentration throughout lactation. McDam and O'Dell, (1982) reported that sodium, calcium and cobalt fluctuated at different stages of lactation while phosphorus, total serum protein and sulfur concentrations were depressed at calving.

In the present study, three recumbent cows with hypomagnesmia had a significant reduction in the serum magnesium level (1.40

± 0.21 mg/dL) when compared to the mean magnesium value of the control animals. Calcium concentration was depressed at calving although magnesium concentration was elevated at calving.

Baumgartner and Gattinger, 1982 recorded hypomagnesemia while Narayana *et al., (*1977) observed normal magnesium level in downer cows. The hypocalcemia, hypophosphataemia, hypokalemia or hypomagnesemia noticed in the present study were supported by the reports of the above authors.

Otter, (2013) reported a significantly elevated mean creatinine kinase and gamma glutamyl transferase was noticed in all the recumbent cows when compared to their respective mean serum values of control animals.

Serum enzyme activity reflected the tissue mass and tissue activity and, with skeletal muscle being the largest and most active of the tissues, this was the origin of nearly all of the enzyme activity detected in blood samples. The enzyme was released in response to muscle injury and inflammation, so increased serum activity would be detected in cases of myopathy and myositis. The enzyme activity increased in serum rapidly when tissue damage occurred and it had a relatively short half-life compared with aspartate amino transferase, reflecting its clearance from the blood. Particularly high levels could be found with myopathies. Cox *et al.,* (1982) and Cox, (1988) in their study with downer cows, observed marked elevation of serum creatinine kinase enzyme levels with highest creatinine kinase levels were observed at 24 hours in the ambulatory group and at 48 hours in the downer group. Creatine kinase, aspartate aminotransferase and lactate dehydrogenase could be used as a guide to the degree of muscular damage and therefore might assist prognostication.

Table.1 Haematology in apparently healthy and recumbent cows

Sl. No.	Parameters	Apparently healthy cows (n=20) Mean ± SE	Metabolic disorders (n=186) Mean ± SE	Abdominal dysfunction (n=132) Mean ± SE	Infectious causes (n=42) Mean ± SE	Intoxication (n=17) Mean ± SE	Musculo skeletal and nervous disorders (n=179) Mean ± SE	p
1.	Haemoglobin (g/dL)	$12.29^a \pm 0.38$	$11.67^a \pm 0.79$	$13.55^b \pm 0.39$	$11.80^a \pm 0.59$	$11.10^a \pm 0.67$	$11.15^a \pm 0.29$	0.04
2.	Packed cell volume (%)	$37.57^a \pm 1.10$	$35.79^a \pm 2.78$	$41.97^b \pm 2.19$	$35.20^a \pm 1.76$	$32.17^a \pm 0.82$	$34.19^a \pm 0.95$	0.03
3.	Red blood cell (x 10^6/cumm)	5.94 ± 0.06	6.15 ± 0.48	5.27 ± 0.20	6.01 ± 0.30	5.99 ± 1.13	5.78 ± 0.18	0.09
4.	White blood cell (x 10^3/cumm)	$6.50^a \pm 0.21$	$6.12^a \pm 1.22$	$7.23^a \pm 0.33$	$12.17^b \pm 1.88$	$11.13^b \pm 0.33$	$11.11^b \pm 1.10$	0.001
5.	Neutrophils (%)	$38.29^a \pm 1.46$	$40.86^a \pm 4.72$	$67.06^b \pm 2.03$	$72.09^c \pm 5.69$	$55.11^b \pm 4.17$	$59.68^b \pm 2.07$	0.001
6.	Lymphocytes (%)	$60.25^c \pm 5.38$	$58.50^c \pm 4.56$	$32.30^b \pm 2.07$	$16.08^a \pm 2.05$	$33.11^b \pm 1.62$	$28.18^b \pm 2.13$	0.002
7.	Monocytes (%)	1.03 ± 0.27	1.64 ± 0.73	1.40 ± 0.18	1.61 ± 0.42	1.63 ± 0.18	1.21 ± 0.12	0.07
8.	Eosinophils (%)	0.40 ± 0.15	1.11 ± 0.12	0.29 ± 0.19	0.60 ± 0.17	0.07 ± 0.01	0.15 ± 0.05	0.02

Mean bearing same superscript in same row do not differ significantly p< 0.01 Highly significant

Table.2 Serum biochemistry in apparently healthy and recumbent cows

Sl. No.	Parameters	Apparently healthy cows (n=20) Mean ± SE	Metabolic disorders (n=186) Mean ± SE	Abdominal dysfunction (n=132) Mean ± SE	Infectious causes (n=42) Mean ± SE	Intoxication (n=17) Mean ± SE	Musculo skeletal and nervous disorders (n=179) Mean ± SE	p
1.	Total protein (g/dL)	$7.58^b \pm 0.16$	$6.71^b \pm 0.31$	$5.95^a \pm 0.24$	$6.50^b \pm 0.44$	$6.82^b \pm 1.11$	$6.31^b \pm 0.13$	0.001
2.	Albumin (g/dL)	3.90 ± 0.10	3.73 ± 0.09	3.58 ± 0.14	3.24 ± 0.16	3.91 ± 0.18	3.85 ± 0.10	0.07
3.	Calcium (mg/dL)	$9.92^b \pm 0.54$	$8.51^a \pm 0.53$	$8.24^a \pm 0.38$	$8.21^a \pm 0.53$	$8.01^a \pm 0.67$	$8.34^a \pm 0.29$	0.005
4.	Phosphorus (mg/dL)	6.32 ± 0.22	5.74 ± 0.53	5.54 ± 0.62	4.89 ± 0.32	5.11 ± 0.91	5.60 ± 0.71	0.02
5.	Magnesium (mg/dl)	2.12 ± 0.15	1.98 ± 0.40	2.17 ± 0.23	2.20 ± 0.09	2.18 ± 0.17	1.98 ± 0.23	0.07
6.	Potassium (mEq/L)	$4.58^b \pm 0.11$	$3.50^a \pm 0.30$	$4.12^b \pm 0.19$	$4.43^b \pm 0.38$	$4.14^b \pm 0.11$	$3.19^a \pm 0.11$	0.001
7.	Creatinine kinase (IU/L)	$33.17^a \pm 17.61$	$>1500^C$	$>1500^C$	$>1500^C$	$789.16^b \pm 79.88$	$1260.24^b \pm 89.83$	0.002
8.	Gamma Glutamyl transferase (IU/L)	$16.22^a \pm 1.86$	$35.48^b \pm 2.68$	$24.54^b \pm 3.43$	$22.67^b \pm 1.18$	$33.71^b \pm 3.97$	$34.17^b \pm 6.17$	0.001

Mean bearing same superscript in same row do not differ significantly p< 0.01 Highly significant

Table.3 Haematology in apparently healthy and recumbent cows with metabolic disorders

Sl. No.	Parameters	Apparently healthy cow (n=20) Mean ± SE	Hypocalcemia (n=14) Mean ± SE	Hypophosphatemia (n=71) Mean ± SE	Hypokalemia (n=33) Mean ± SE	p
1.	Haemoglobin (g/dL)	12.29 ± 0.38	10.72 ± 1.13	12.31 ± 1.00	11.89 ± 0.71	0.02
2.	Packed cell volume (%)	37.57 ± 1.10	31.94 ± 3.34	41.19 ± 4.39	35.44 ± 2.26	0.06
3.	Red blood cell $(x\ 10^6/cumm)$	5.94 ± 0.06	5.82 ± 0.64	7.17 ± 0.78	5.86 ±0.38	0.05
4.	White blood cell $(x\ 10^3/cumm)$	6.50 ± 0.21	6.05 ± 0.19	5.82 ± 0.92	6.30 ± 0.35	0.07
5.	Neutrophils (%)	38.29 ± 1.46	45.00 ± 6.41	37.50 ±6.28	45.92 ± 3.99	0.04
6.	Lymphocytes (%)	60.25 ± 5.38	48.67 ± 5.79	61.25 ±6.03	50.34 ±4.18	0.04
7.	Monocytes (%)	1.03 ± 0.27	6.03 ± 1.55	2.25 ± 0.75	3.27 ±0.44	0.02
8.	Eosinophils (%)	0.40 ± 0.15	0.10 ± 0.01	0.25 ± 0.11	2.17 ±0.24	0.06

Mean bearing same superscript in same row do not differ significantly $p < 0.01$ Highly significant

Table.4 Serum biochemistry in apparently healthy and recumbent cows with metabolic disorders

Sl. No	Parameters	Apparently healthy cow (n=20) Mean ± SE	Hypocalcemia (n=14) Mean ± SE	Hypophosphatemia (n=71) Mean ± SE	Hypokalemia (n=33) Mean ± SE	p
1.	Calcium (mg/dL)	$9.92^b \pm 0.54$	$6.23^a \pm 0.78$	$10.32^b \pm 0.38$	$10.49^b \pm 0.56$	0.001
2.	Phosphorus (mg/dL)	$6.32^b \pm 0.22$	$6.05^b \pm 1.32$	$3.91^a \pm 0.27$	$6.11^b \pm 0.27$	0.005
3.	Magnesium (mg/dL)	2.12 ± 0.15	2.13 ± 0.15	2.27 ± 0.23	2.19 ± 0.13	0.05
4.	Potassium (mEq/L)	$4.58^b \pm 0.11$	$4.46^b \pm 0.58$	$4.45^b \pm 0.30$	$2.44^a \pm 0.14$	0.002

Mean bearing same superscript in same row do not differ significantly p< 0.01 Highly significant

However Huxley, (2006) no longer routinely used these tests as they were difficult to interpret with any degree of certainty because accurate 'cut-off points' were not easy to establish. The elevated creatine kinase in recumbent cows under the present study was supported by the observations of the above authors. In addition, the elevated serum creatine kinase could be used to guide for degree of muscular damage and should not be used for correlation with the number of days of recumbency.

Acknowledgements

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