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Diagnosis and therapeutic management of recumbent COWS

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Abstract

The study comprised of ten apparently healthy cows and 20 clinical cases of recumbent cows. Data collected from the apparently healthy cows on various parameters served as control values in the study. Recumbent cows were screened by using a specially designed data sheet and subjected to detailed clinical examination, haematology, serum biochemical profile. Sixteen recumbent cows with metabolic disorder were treated with suitable therapy. In case of recumbent cows with hypocalcaemia along with hypophosphatemia were treated with Mifex (Ca, P and Mg preparation) intravenously. In case of recumbent cows with hypokalaemia the animals were treated with potassium chloride 1.5 mEq/ Kg B. Wt-orally for 5 days. Body sling was used to lift the all recumbent cows. Treatment was carried out continuously for the period of 7 days. Qualitative evidence of clinical improvement and quantitative improvement of hemogram, leukogram, serum biochemical profile was observed on 7th day of post treatment. Out of the 20 recumbent cows presented during the study period the various etiologies included were metabolic disorders (70%), musculoskeletal disorders (30%). The present study revealed various etiologies among the metabolic disorders were hypophosphatemia along with hypocalcaemia (56 per cent), hypokalaemia (44 per cent). Hypophosphatemia was frequently associated with hypocalcaemia in early lactating cows and with hypokalaemia in cows with pronounced or prolonged feed intake depression. In the present study the Hb, PCV and TEC values in recumbent cows within the normal range. There was a significant difference in TLC and DLC was observed in recumbent cows when compared with control group. The present study revealed a significantly elevated mean CPK, LDH and AST in all the recumbent cows when compared to their means of serum values of control animals. The raise in the serum enzymes (CPK, LDH and AST) were the outcome of muscular damage. The present study demonstrated that two recumbent cows were died during the course of treatment and six animals were not responded to the course of treatment. In the present study eight cows were stood up with normal defecation, urination with good appetite of 7 days post treatment. These recovered eight recumbent cows were responded to body sling and medical treatment. The present study revealed correction of primary etiology and prevention of secondary damage with body sling, proper care and management allowed the downer cows to stand 7 days of post treatment. The cause of death of two recumbent cows in the present study was attributed to severe hypokalaemia and marked secondary damage.

Keywords: Recumbent cows, Metabolic disorders, Hypocalcaemia and hypophosphatemia, Hypokalaemia, Body sling therapy

Introduction

Downer cow syndrome is characterized by inability of the cow to stand voluntarily from recumbency and generally associated with hypocalcemia, hypophosphatemia, hypokalemia, hypomagnesemia, toxemia, septicemia, muscle and nerve paralysis (Andrews *et al.*, 1992) [3]. The syndrome occurs most commonly within 2 or 3 days after calving in high producing dairy cows. Recumbency in dairy cattle is major concern in dairy farming across the globe, it occurs mainly in early post parturient period and is usually caused by multiple disease process (metabolic, In India the exact incidence of downer cow syndrome is not known, but the incidence is presumed to be high in certain dairy farms in Indian subcontinent. The incidence of downer cow syndrome was reported to be 3-5% in U.S, U.K & New Zeland. (Constable *et al.*, 2017) [8]. Regardless of the cause, the prolonged recumbency results in varying degrees of ischemic necrosis of major hind limb muscles, particularly the semitendinosus muscle and muscle caudal to stifle.

The diagnosis and treatment of recumbent animal is challenging and frustration to the field veterinarian, therefore medical management should address hydration status, inflammation, infections and metabolic disturbances. Recumbent dairy cattle should be treated as soon as possible without delay not more than for 1 hour. Various therapeutic regimen has been advocated by different authors across the globe for the therapeutic management of recumbent cows, it includes replacement therapy with Ca, P, Mg, K and glucose containing preparations, provision of comfortable bedding material, lifting devices and physiotherapy by muscle massage. Early diagnosis and suitable therapy of a recumbent cow associated with metabolic disturbance will improve its survival time and the quality of life of animal. The etiological diagnosis and institution of prompt therapy of recumbent cow is always in favour of farm economy. So far, no systematic work has been done on recumbent cows in Andhra Pradesh particularly on etiological diagnosis and treatment aspects. Keeping in view of the above facts the study designed with following objectives.

1. To identify certain etiological factors and prognostic indicators of recumbent cows.
2. To record the clinical signs and haemato-biochemical findings in recumbent cows.
3. To treat selected recumbent cows with a suitable therapy.

Materials and Methods

The study entitled "Clinico-diagnostic and therapeutic studies on recumbent cows" was conducted in the Department Veterinary Clinical Complex, College of Veterinary Science, Tirupati, Chittoor, Andhra Pradesh for a period of two semesters from December 2019 to December 2020. The materials and methods used in the present research are detailed under this chapter. Animals The cows that were brought to the large animal medicine ward, Department of Veterinary Clinical Complex, College of Veterinary Science, Tirupati and surrounding Veterinary Dispensaries during the period from December 2019 to December 2020 in recumbent

position were considered for the present study. Control animals Apparently healthy cows selected from the cases that brought for regular check-up were taken as control group for obtaining normal data for comparison of parameters under study. The cows under recumbent position were included in the present study. Recumbent cows were examined thoroughly by collecting history and detailed study of clinical signs and physical examination and the data was recorded in a proforma specially designed for the data collection. Five millilitres of blood was collected from the jugular vein of the recumbent cows using sterile disposable syringes into vacutainers containing EDTA and haematological parameters such as packed cell volume, haemoglobin, total erythrocyte count, total leukocyte count and differential leukocyte count were estimated as per the standard procedures mentioned by Kaneko *et al.*, (2009) [25]. For separation of serum, 5 ml of blood was collected in clot activator vacutainer. Serum was separated immediately after clotting by centrifugation at 2000 rpm for 5 minutes. Serum biochemical parameters viz., total protein (TP), albumin, aspartate transaminase (AST), creatinine phosphokinase (CPK), lactate dehydrogenase (LDH), blood urea nitrogen (BUN), creatinine, Calcium (Ca), Phosphorous (P), and Potassium (K), were estimated with semi auto analyser (Star 20, Rapid Diagnostics, New Delhi) by employing the biochemical kits supplied by M/S ERBA diagnostics, Mumbai at the wave lengths specified in the procedures. Out of twenty recumbent cows, sixteen recumbent cows were selected and divided into two groups based on etiology for the treatment. The criteria for selection into treatment includes:

- Alert downers free from fractures and dislocations
- Non alert recumbent cows are not included in the present study.

On the basis of etiology the recumbent cows were divided into two groups and randomly allotted into the following treatment.

Group	No. of cows	Etiology	Treatment
1	09	Hypocalcaemia + Hypophosphatemia	1. Inj. Mifex- 450 ml I/V for alert cow (Calcium Magnesium Borogluconate) 2. Inj. Catasol 15 ml I/V (Inorganic Phosphorous) Kumari and Kaswan (2015) [30]
2	07	Hypokalemia	Potassium chloride powder 30 grams orally Kumari and Kaswan (2015) [30]

The following supportive therapy was given to two groups for a week long period

- Inj. Tribivet 10 ml per cow - I/V
- Inj. Meloxicam 0.5 mg/Kg b.wt - I/M
- E Care Se liquid 20 ml per cow orally
- Body sling was used to lift all recumbent cows.

The animal owners were advised to provide physiotherapy, ideal bedding and balanced diet. The results obtained were subjected to Statistical analysis as per the methods using SPSS 23.00 version.

Results and Discussion

The study entitled Clinico-diagnostic and therapeutic studies on recumbent cows was conducted in the Department of Veterinary Clinical Complex, C.V.Sc., Tirupati, Chittoor for the period of two semesters from December 2019 to December 2020. In the present study recumbent cows presented to large animal ward of Veterinary Clinical

Complex, C.V.Sc., Tirupati and nearby hospitals were examined. Periparturient animals (50%) highest incidence of recumbent cow syndrome was observed when compared to pregnant (30%) and lactating cows (20%). This could be due to metabolic disturbances and various disease conditions that commonly occur at higher rate in periparturient animals compared to pregnancy/ lactation reported by Smith, (2009). Van Metre *et al.*, (2001) [36, 38] reported that downer cows were a common presentation in the periparturient period. The downer cow syndrome episode frequently occurred within 24 hours of calving in dairy cows. Highly productive cows and older cows were at greater risk of downer cow syndrome. Clinical hypocalcaemia, stillbirth, and dystocia were all identified as risk factors for downer cow syndrome in dairy cattle in the first 30 days after parturition. Constable *et al.*, (2017) [8] reported that the downer cows were high producers (48 per cent) and approximately 58 per cent of cases occurred within one day of parturition and 37 per cent occurred during the first 100 days of lactation. Higher incidence of recumbent

cows in periparturient period in the present study was supported by the reports and observations of the Van Metre *et al.*, (2001) and Constable *et al.*, (2017) ^[8, 38]. Twenty recumbent cows presented during the study period and the various etiologies included were metabolic disorders (70%), musculoskeletal disorders (30%). Caple, (1986) ^[7] reported that there was no universal cause of the downer cow syndrome, but it was most frequently a sequela to milk fever where complications, such as muscle necrosis and nerve paralysis, could arise because of delayed or insufficient calcium replacement. Green *et al.*, (2008) ^[20] opined that the risks included metabolic illnesses such as hypocalcaemia and ketosis, infectious diseases such as mastitis and metritis, and other maladies such as dystocia and hoof and leg injuries that caused lameness. Fenwick, (1969) ^[16] reported that non ambulatory cows were unable or unwilling to stand and remained recumbent for ≥ 12 h. Cox *et al.*, (1982) ^[13] reported that 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. The various etiologies for the recumbency noticed in the present study were supported by the reports of the above authors. The various etiologies among the metabolic disorders (16 cases) in the present study were hypophosphatemia along with hypocalcaemia (56 per cent) and hypokalaemia (44 per cent). Dima *et al.*, (1999) and Gahlawat *et al.*, (2007) ^[14, 17] reported that hypophosphatemia had been a predisposing factor for typical periparturient diseases of dairy animals such as the post parturient haemoglobinuria and downer cow syndrome. Hypophosphatemia was frequently associated with hypocalcaemia in early lactating cows and with hypokalaemia in cows with pronounced or prolonged feed intake depression (Grunberg 2014). Barlet and Davico (1992) Kojouri, (2003) ^[5, 28] reported that hypophosphatemia was a major cause of prolonged sternal recumbency and poor response to routine therapy for milk fever, and it was thought that this resulted in a cow that fail to rise after routine treatment. Hypokalaemia has been reported in downer cows by Allen & Davis (1981) ^[1]. Hypokalaemia in recumbent cows occurs due to the fact that muscle ischaemic as a result of prolonged recumbency increases the cell membrane permeability of muscle fibres and allow loss of potassium from the cell during myotonia which appears to be the basis of downer cow syndrome (Andrews *et al.*, 1992) ^[3]. Hypokalaemia could also occur due to the rapid urinary excretion and diminished alimentary absorption of potassium associated with reduced feed intake. Diminished excitability of nerve and muscle cells, weakness and flaccid paralysis are the consequences of hypokalaemia (Kowarlezky and Mayer 1972). Hypophosphatemia, hypocalcaemia and hypokalaemia contributing for the recumbency in the cows under present study were in concurrence with the reports of the above authors. The various musculoskeletal and nervous disorders contributing for recumbent cow in the presence study included peroneal nerve paralysis (1 per cent), radial nerve paralysis (1 per cent), stifle joint injury (2 per cent). Huxley, (2006) ^[22] reported that fractures (femur, pelvis), dislocations (hip, sacro iliac) and muscular (rupture of the hind limb adductors or gastrocnemius or severe bruising due to heavy falls onto concrete could be considered as primary causes of recumbency in cattle. The causes of recumbency with downer cow syndrome can be difficult to determine because of the inter-play between the primary causes of recumbency and the secondary damage resulting from, the

recumbency. Some cows will be affected by the primary cause, some from the combination of primary and secondary complications and others from only secondary complications (Burton *et al.*, 2009) ^[6]. In this study of 20 field cases of commercial dairy cows that had been recumbent for more than 1 day and were bright and alert was found that in most cases the secondary damage was more important than the primary cause of the recumbency. It was also found that the level of nursing care provided was a major driver of outcome. These clinical findings of a recumbent cow were in agreement with Poulton *et al.*, (2020) ^[32]. Downer cows defined as bright, alert and responsive cows that have been recumbent for at least one day, are challenging for veterinarians. They can be difficult to examine and the associations between the primary cause and the secondary damage as a result of their recumbency, the conditions under which they have been cared for and their outcome are half and poorly understood. Clinically the downer cows were appeared bright and alert but not off fed. The body temperature and other physiological parameters were in the normal range. The alert recumbent cows tried to stand up repeatedly but could not raise to their feet. They could raise their fore quarters, but fail to put-up on hind quarters. 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 (Ganti, 2019) ^[18]. However, a non-significant difference was observed in values of Hb, PCV and TEC in recumbent cows compared to control group as reported in earlier studies (Sivaraman *et al.*, 2019) ^[35]. In the present study there was a significant difference in TLC and DLC was observed in recumbent cows when compared with control group. However recumbent cows with abdominal dysfunction, infectious causes, musculoskeletal and nervous disorders had significant lymphopenia with neutrophilia when compared to their respective control means (Alsaad 2011, Kirbas *et al.*, 2015 and Duraj and Ceroni 2018). Wood (2019) ^[2, 15, 27, 40] opined that marked neutrophilia observed in all the recumbent cows might be due to infection, catecholamine or glucocorticoid response due to stress or inflammation. The mean serum biochemical values (Ca, P, K, BUN, Creatinine, Total Protein, Albumin, CPK, LDH) of apparently healthy cattle in the present study were within the normal range reported by Kaneko *et al.*, 2009 ^[25]. Recumbent cows with hypocalcaemia 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) ^[23, 33] opined that typical symptoms of hypophosphatemia occurred when the level of inorganic phosphorus was lower than 2-2.1 mg/ dL. Recumbent cows with hypokalaemia had a significantly lower value of mean serum potassium when compared to their respective mean values of control animals. Mature cows fed with trace mineralized salt maintained lower potassium concentration throughout lactation. McDam and O'Dell, (1982) ^[31] reported that sodium, calcium and cobalt fluctuated at different stages of lactation while phosphorus, total serum protein and sulphur concentrations were depressed at calving. The hypocalcaemia, hypophosphatemia, hypokalaemia noticed in the present study were supported by the reports of the above authors. The present study revealed a significantly elevated mean CPK, LDH and AST in all the recumbent cows when compared to their means of serum values of control animals. These findings were in agreement with earlier studies (Wadhwa and Prasad, 2002, Kheirabadi *et al.*, 2014 and Otter 2013) ^[26, 39].

Serum enzyme activity reflected the tissue mass and tissue activity and, with skeletal muscle being the largest and most active part of the tissues and 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. Cox *et al.*, (1982) ^[13] in their study with downer cows, observed marked elevation of serum creatinine kinase enzyme levels with highest creatinine kinase levels 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. The elevated CPK, LDH and AST in recumbent cows under the present study was supported by the observation of the above authors, in addition, the elevated CPK should be used to guide for degree of muscular damage and should not be used for conclusion with number of days of recumbency. The mean values of AST, CPK in downer cows were significantly high in comparison to healthy control cows. Prolonged recumbency causes ischaemic necrosis of muscles (Cox *et al.*, 1982 and Kachhawaha and Tanwar 2010) ^[13, 24] resulting in increased permeability of cell membrane allowing seepage of AST, CPK enzymes into circulation. CPK is considered as a specific marker of muscle damage (Shipgel *et al.*, (2015) and increase in CPK testified ischaemic damage to the muscle causing its seepage into the circulation. The study revealed that there was an elevation in BUN and creatinine in recumbent cows but the values were within the normal range. The values of total protein, albumin were significantly reduced when compared with the values of control group. In the present study hypoproteinaemia and hypoalbuminemia were attributed to reduced feed intake in recumbent cows. The present study demonstrated that two recumbent cows were died during the course of treatment and six animals were not responded to the course of treatment. In the present study eight cows were stood up with normal defecation, urination with good appetite of 7 days post treatment. These recovered eight recumbent cows were

responded to body sling and medical treatment including parenteral administration of Mifex (Ca, Mg and P preparation) and oral administration of Potassium chloride. More secondary damage in heavy downer cows suffering from parturient paresis and hypophosphatemia may result in incomplete response and lead to failure of animal to raise. The present findings were in accordance with Constable *et al.*, 2017. Fenwick (1969) ^[8, 16] observed that there was definite increase in number of downers and deaths with decreasing potassium concentration. The course of a downer cow syndrome is variable and is dependent on the nature and extent of the lesions and the quality of care and comfort during the first few days of recumbency. About 50% of the downer cows will stand within 4 days or less if cared for properly, but the prognosis is poor for those that are still recumbent after 7 days, although some affected cows have been down for 14 days and subsequently stood up and recovered. The present study revealed correction of primary etiology and prevention of secondary damage with body sling, proper care and management allowed the downer cows to stand 7 days of post treatment. Cox and Marion (1992) ^[10] stated the important management include fluid and electrolyte therapy, bedding and clinical care and use of cow lifting device. The cause of death of two recumbent cows in the present study was attributed to severe hypokalaemia and marked secondary damage. Six cases of recumbent cows were not responded to the selected treatment and this might be due to delaying the admission of recumbent cows to Veterinary Clinical Complex and with presence of systemic involvement with elevation of serum enzymes (CPK, LDH and AST) and improper care by the animal owners. These findings were in accordance with Asl *et al.*, (2010) ^[4]. The response to treatment was favourable in cases where the downers attempt to raise and poor in delayed downers and cases of nerve injury. Body sling is an effective and humane way to lift the recumbent cows. The successful recovery rate in recumbent cows with body sling was up to 50%, So the present findings were in agreement with Cox and Marion (1992) ^[10].

Table 1: Hematological findings in Apparently healthy and recumbent cows

Parameter	Apparently Healthy animals (N=10)	Recumbent cows (N=20)	P value
Haemoglobin (g/dL)	9.96±1.57	9.5±0.67	0.19NS
Packed cell volume (%)	33.32±2.03	34.46±1.30	0.628 NS
Total erythrocyte count (×10 ⁶ /μl)	8.21±1.80	8.12±1.20	0.18 NS
Total leucocyte count (×10 ³ /μl)	7.70±1.17	12.32±1.51	0.001**
Neutrophils (%)	34.77±2.02	61.55±2.55	0.000**
Neutrophils (%)	61.50±2.05	37.60±2.55	0.000**

**P≤ 0.01 Statistically highly significant, *P≤0.05 Statistically significant

Table 2: Serum biochemical parameters in Apparently healthy and recumbent cows

Parameter	Apparently Healthy animals (N=10)	Recumbent cows (N=20)	P value
Calcium (mg/dL)	10.04±0.37	8.61±0.30	0.007**
Phosphorous (mg/dL)	6.09±0.25	4.28±0.165	0.000**
Potassium (mEq/L)	4.82±0.17	3.6±0.32	0.014*
AST (IU/L)	104.74±8.34	154.09±10.83	0.006**
BUN (mg/dL)	20.49±1.78	24.01±0.43	0.078NS
Creatinine (mg/dL)	1.23±0.16	1.32±0.41	0.29NS
Total Protein (g/dL)	7.34±0.33	6.32±0.18	0.007**
Albumin (g/dL)	3.08±0.15	2.20±0.12	0.000**
CPK (U/L)	138.55±67.38	1584.53±206.98	0.001**
LDH (U/L)	1743.5±283.3	2801.40±98.21	0.005**

**P≤ 0.01 Statistically highly significant, *P≤0.05 Statistically, P>0.05 Non-significant

Table 3: Hematological observations in recovered cows before and after treatment

Recovered cases (No=8)	Before treatment	After treatment
Haemoglobin (g/dL)	9.11±0.75	9.88±0.61
Packed cell volume (%)	29.37±2.64	31.86±1.22
Total erythrocyte count (×10 ⁶ /μl)	29.37±2.64	31.86±1.22
Total leucocyte count (×10 ³ /μl) **	6.71±1.52	9.83±1.19
Neutrophils (%) *	40.81±5.28	30.57±1.94
Lymphocytes (%)	58.44±3.56	65.00±1.88

**P≤ 0.01, *P≤0.05

Table 4: Biochemical picture of recovered cows before and after treatment

Recovered cases (No.=8)	Before treatment	After treatment
Calcium (mg/dL) **	8.27±0.92	10.25±0.22
Phosphorous (mg/dL) *	4.33±0.13	4.62±0.12
Potassium (mEq/L) **	3.90± 0.19	4.76±0.20
AST (IU/L) *	136.80± 0.40	124.81±5.99
BUN (mg/dL) NS	23.40± 1.99	22.25±0.46
Creatinine (mg/dL) NS	1.93±0.12	1.90±0.16
Total Protein (g/dL) *	6.73±0.79	7.58±0.16
Albumin (g/dL) *	3.65±0.50	2.93±0.08
CPK (U/L) NS	1043.79±232.01	997.44±45.44
LDH (U/L) NS	2731.5±463.07	2480.25±71.78

**P≤ 0.01 Statistically highly significant, *P≤0.05 Statistically significant, P>0.05 Non significant

**Plate 1:** Recumbent Cow 1 Before Treatment**Plate 2:** Recumbent Cow 1 After Treatment**Plate 3:** Recumbent Cow 2 Before Treatment**Plate 4:** Recumbent Cow 2 After Treatment



Plate 5: Recumbency in cow due to stifle joint injury



Plate 6: Recumbency in cow due to peroneal nerve paralysis

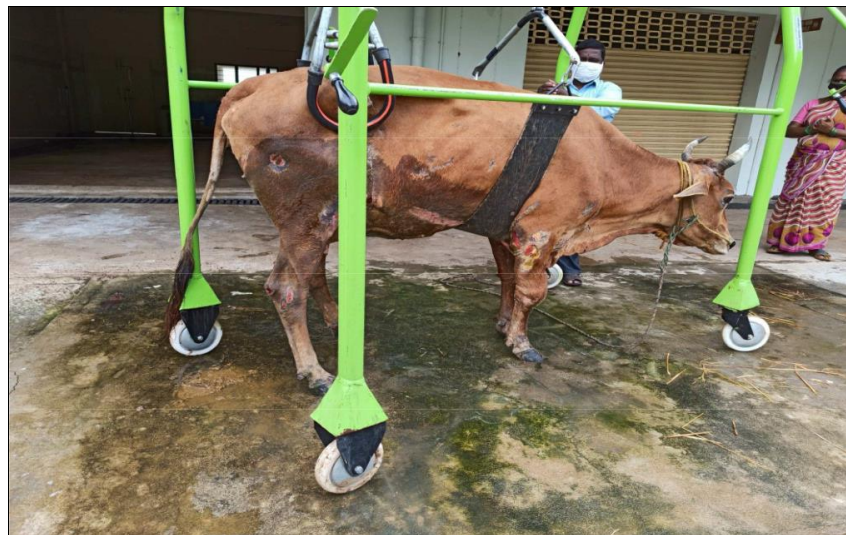


Plate 7: Recumbent animal showing decubitus ulcers

Summary

Hypocalcaemia associated with hypophosphatemia and hypokalaemia were identified as a etiology of recumbent cow syndrome. The recumbent cows with marked elevation of serum enzymes (CPK, LDH and AST) with severe hypokalaemia were identified as a poor prognostic indicators. The early correction of primary etiology and using body sling for the lifting of recumbent cows were found to be useful in the therapeutic management of recumbent cow syndrome.

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