



Original Research

Ionized Calcium and Electrolyte Profile in Downer Cows: A Retrospective Study of 50 Cases (2016-2018)

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Abstract

The present study was designed to evaluate ionized calcium and other electrolyte parameters of crossbred dairy downer cows in dried up Cauvery Delta region of Tamil Nadu. Downer cow syndrome (DCS) is an important condition of dairy cows which occurs following hypocalcemic parturient paresis. Animals brought to the Large Animal Medicine Referral Unit, Orathanadu with the complaint of inability to rise were selected for this study. Those animals didn't have any musculoskeletal and gastrointestinal disorders were chosen in this study for a period of two years. Blood samples were collected and serum electrolytes like Potassium (K), Sodium (Na), Chloride (Cl), ionized calcium (iCa) and total calcium (TCa) along with pH were analyzed. The results were compared with normal control group. When compare to the healthy animals significant variations were observed in potassium and ionized calcium values of recumbent cows at $p < 0.05$ level. From this study we conclude that the decreased level of potassium exist along with lower ionised calcium values. Hence, considering potassium therapy is essential in downer cows of delta region of Tamil Nadu.

Key words: Downer Cows, Electrolyte Profile, Hypokalemia, Ionized Calcium

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Introduction

Downer cow syndrome is a major concern in dairy farming across the globe. It occurs mainly in the early post parturient period and is usually caused by multiple disease processes. The most common cause of downer cow syndrome is hypocalcaemia approximately 58% with the disease manifest within 1 day of parturition with 37% occurring during the first 100 days of lactation. The case fatality rate was 11% higher



in pre-calving recumbent cows than post-calving cows. The disease occurs most commonly in the first 2 or 3 days after calving in heavy milk producers and, in many cases, it occurs concurrently with parturient paresis (Ramon *et al.*, 2016). The ability to analyze an affected cow's serum iCa status is often desirable in retrospect when a poor clinical response to therapy occurs. The availability of rapid iCa determination is often inaccessible to many veterinarians when the animal is initially ill due to rural practice settings, producer economic concerns and commercial laboratory is closed. This present paper describes the importance of ionized calcium and other electrolyte alterations in clinical cases of downer cows in the delta region of Tamil Nadu.

Materials and Methods

Fifty dairy cows of 3 to 8 years with a history of inability to rise voluntarily for the varied period of time were referred to the Large Animal Medicine Referral Unit, Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Orathanadu between May 2016-May 2018 were selected for this study. The data collected in this study include age of the animal, parity, date of calving, recent health and production problems and hours from the onset of recumbency. Mastitis, metritis and bone fractures were ruled out through physical and clinical examination of these animals. Clinically the downer cows appeared bright and alert but off-feed. The body temperature was within normal range. Animals tried to stand-up repeatedly but could not rise without assistance. They could raise their forequarters, but failed to put up weight on hind quarters. Twelve healthy cows were included from livestock farm of this institute to serve as control. About ten millilitre of blood was collected from each animal and serum was separated and analyzed. Reliable calcium ion-selective electrodes are now available and make it possible to directly measure iCa in serum, plasma, and blood. Direct measurement of serum iCa was performed on a (ALLCARE AC 9801, Allied Biotechnology India Pvt. Ltd.) electrolyte analyzer with simultaneous determination of Potassium (K), Sodium (Na), Chloride (Cl), total calcium (TCa) and pH.

Statistical Analysis

Statistical analysis was performed using Student's 't' test by a software program (SPSS, version 16.0, SPSS Inc, Chicago, IL, USA).

Results

The levels of Potassium and ionized calcium were significantly lower in downer cows compared with healthy cows at $p < 0.05$ level (Table 1). The sodium concentration in downer cows was within normal range. Some of the downer cows suffered severe hypocalcemia (iCa concentrations as low as 0.7 mmol/L). In many of the affected cows plasma K concentration is less than 1.8 mmol/L.

Table 1: Electrolyte parameters in downer and healthy cows

Parameters	Downer Cows	Apparently Healthy Dairy Cows	't' Value	'p' Value	P<0.05
Pottasium (mmol/L)	3.86± 1.10	5.11±0.69	-2.43596	0.01812	**
Sodium (mmol/L)	133.74±16.92	131.2±3.82	0.3923	0.696356	NS
Chloride (mmol/L)	103.48±14.91	97.53±2.42	1.0456	0.30032	NS
Ionized Calcium mmol/L	0.89±0.20	1.23±0.07	-4.43532	0.000087	**
Total Calcium mmol/L	1.63±1.08	2.20±0.12	-1.37708.	0.174068	NS
pH	6.58±0.91	7.38±0.91	-2.03648	0.046528	**

** Significant at $P<0.05$ level and NS indicated Non-Significant

Discussion

The present study reports hypokalemia in downer cows which is in agreement with the earlier reports of Andrew *et al.* (1992) who documented decreased levels of potassium in recumbent cows as compared to the healthy dairy cows. The downer cows had significantly lower serum iCa concentration compared with the healthy cows. This was expected, because hypocalcemia is the most frequent cause of recumbency in fresh cows (Barrington, 1998). Subhash and Tanwar (2010) were reported that significant low concentration of calcium and potassium were observed in downer cows. This is in agreement with our present study. Normal bovine plasma K concentration is about 3.9–5.8 mmol/L. Cattle ordinarily consume diets that contain more than enough K to meet their tissue requirements (Radostits *et al.*, 2007). Since nearly all of the dietary K is absorbed across the intestinal tract preventing an excessive increase in plasma K is a daily reality. As a general rule, K homeostasis will effectively prevent severe hypokalemia, if the animal is only off feed for a few days (before muscle is severely depleted of K). The degree of hypokalemia observed simply from inappetance of just 4-5 days is unlikely to be severe enough to cause flaccid paralysis in the cow. The severely hypokalemic cow tends to be very depressed. Though inappetance will greatly reduce the amount of K entering extracellular pools some other factor must also be causing depletion of extracellular and intracellular K. Hypokalemia, as a cause of the downer cow syndrome, is common and the cases that do occur often are caused by human intervention as explained below. In most reports concerning clinical cases of hypokalemia and recumbency in cows the plasma K concentration is less than 2.5 mmol/L (Sielman *et al.*, 1997; Sattler *et al.*, 1998 and Peek *et al.*, 2003).

The degree of hypokalemia observed simply from inappetence of just 4–5 days is unlikely to be severe enough to cause flaccid paralysis in the cow. The severely hypokalemic cow tends to be very depressed. Though inappetence will greatly reduce the amount of K entering extracellular pools some other factor must also be causing depletion of extracellular and intracellular K. The possibilities causing low plasma K include exaggerated renal excretion of K and excessive uptake of K by cells. The possibilities causing intracellular K depletion include prolonged fasting and exaggerated renal excretion of K. Hypokalemia

could also occur due to 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 (Kowalczyk and Mayer, 1972).

However, the types of clinical signs seen are rarely attributed specifically to hypokalemia, which is an electrolyte abnormality not typically associated with muscle weakness, recumbency, and the downer cow syndrome. As a result of our investigation, Downer cows should be treated with potassium in addition to calcium after electrolyte analysis. Accurate determination of serum iCa is dependent on careful sample collection, transport, and timely analysis to minimize pH changes.

Conclusion

Since iCa is more clearly related to the clinical and functional status of the cow's calcium metabolism than the measurement of total calcium (Tca). It would enhance diagnostic interpretation and also to know this parameter's levels pre- and post-treatment. Herds experiencing prior metabolic problems associated with hypocalcemia could periodically monitor cows at parturition or in early lactation if veterinarians could later evaluate serum obtained during a defined interval. This study could also help to determine the effectiveness of dietary cation-anion difference using the addition of anionic salts in dry cow rations for prevention of parturient hypocalcemia.

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