

Theriogenology of Pre and Post-parturient Downer Syndrome and Persistent or Recurrent Hypocalcaemia, in Cows and Buffaloes of Small Farmers, in Rural Areas of Rayalaseema Region

Bala Krishna Rao Dabbir^{1*} and Venkata Siva Reddy Santimalla²

¹Sreepathi Veterinary Services, Kadapa, Andhra Pradesh, India

²Assistant Director, Veterinary Hospital, Sambepalli, Andhra Pradesh, India

*Corresponding author: bdabbir@gmail.com

ABSTRACT

Theriogenology of pre and post parturient downer syndrome and persistent or recurrent hypocalcaemia, in 20 cows and 2 buffaloes of Small farmers, during July to October 2018, in rural areas of Rayalaseema Region, were intervened. After witnessing the poor response of conventional treatment which included an infusion of either Calboral or Mifex and Tonophosphan, parenteral phosphorus, all the 22 dairy farmers adopted the new intervention of infusion of calcium enriched Taurine (Taurocal). The recovery was dramatic with a cure rate at 86%. The possible therapeutic effect with regard to calcium homeostasis, stress factors, serotonin modulation and energy metabolism Were discussed.

Keywords: Pre and post parturient downer syndrome, persistent hypocalcemia, infusion of Taurocal-dramatic response –intervention study

Parturient paresis (hypocalcemia) is most likely to affect dairy cattle around the time of parturition. It causes progressive neuromuscular dysfunction and flaccid paralysis. Older dairy cows, cows with a history of parturient paresis during a previous lactation, high-producing cows, and cows from the Jersey and Guernsey breeds are at highest risk for developing parturient paresis (Oetzel 1988).

In most cows, a complete recovery follows a single iv calcium treatment to correct the acute hypocalcemia. However, about 20% of cows treated for parturient paresis experience recurring episodes of hypocalcemia (relapses) requiring further treatment (Goff *et al.* 1989).

An attempt was made to investigate the reasons for these varied responses after infusion of calcium Boro gluconate and to find out a

suitable and fitting intervention to improve the efficacy of calcium Boro gluconate by enriching with Taurine. The ailing 20 downers or recurrent cows and 2 buffaloes, referred to Sreepathi veterinary services, Kadapa for intervention, formed the clinical material, for the study. Taurine, 2-aminoethanesulfonic acid, is an endogenous end metabolite that is distributed in various tissues at high concentration. It is a sulfur-containing amino acid synthesized from cysteine and is excreted without any further metabolism. Since the first discovery of Taurine in 1827, many of its functions have been elucidated in experiments focusing on skeletal muscle, the retina and the central nervous and cardiovascular systems. The cytoprotective actions of taurine contribute to the improvement in the clinical and nutritional health of humans and animals through various

mechanisms, including antioxidation, energy production, neuromodulation, Ca^{2+} homeostasis and osmoregulation. The combination of one or more of these cytoprotective effects of taurine act to diminish the pathology and symptoms of a host of diseases ranging from those of the CNS, cardiovascular system, skeletal muscle and defective metabolism (Schaffer and Kim, 2018).

MATERIALS AND METHODS

Ailing twenty one cows and two buffaloes, were given conventional treatment with either Calboral or Mifex, Tonophosphan, Mecobalmin, injectable Phosphorus, and after poor response, were referred to Sreepathi veterinary services, Kadapa for intervention. The dairy farmers were supplemented neither acidogenic diet nor calcium binders during the transition period.

Taurocal, a product with calcium Boro gluconate, enriched with Taurine, developed by ABT Corporation, Bangalore, were obtained free of cost and infused to the suffering cows. One bottle of Taurocal containing 25% calcium borogluconate and Taurine, was injected intravenously. Rarely second injection was administered.

RESULTS AND OBSERVATION

Out of 22 referred cases, nineteen animals were recovered eventually. The cure rate 86%. Out of 19 recovered cases, only 3 animals were given second Injection of Taurocal (Table 1). The impact of infusion of Taurocal noticed as some downers got up immediately. The others got up within 6 to 12 hours. There was no recurrence of persistent hypocalcemia. The infusion brought out tremendous energy in downers.

DISCUSSION

The reasons for the outstanding results of Taurocal are multifold. The first reason is minimizing the stress of gestation. During the periparturient period, dairy cows suffer marked

immune suppression as well as moderate to severe hypocalcemia (Reinhardt *et al.* 1988; Goff and Horst, 1997). The function of peripheral blood mononuclear cells (PBMC) and neutrophils declines as cows approach parturition and does not recover until 2 to 3 wk after parturition (Kehrli *et al.*, 1989a,b). A key early feature in immune cell activation is an increase in intracellular ionized calcium concentration ($[\text{Ca}^{2+}]_i$), which acts as a second messenger of signal transduction (Grafton and Thwaite, 2001; Lewis, 2001) The decrease in PBMC intracellular Ca stores before parturition and the development of hypocalcemia contributes to periparturient immune suppression (Kimura *et al.* 2006). The important mechanism of taurine cytoprotection is attenuation of endoplasmic reticular (ER) stress. ER stress is an important regulatory mechanism designed to restore ER function and re-establish a balance between protein degradation and protein biosynthesis/folding. When a cell experiences excessive ER stress, pathways are stimulated that can kill the cell (Prentice *et al.* 2015).

The second reason is the effect of Taurine on calcium homeostasis. Ca^{2+} is a universal carrier of biological information: it controls cell life from its origin at fertilization to its end in the process of programmed cell death. Precise maintenance of the physiologic levels of both extracellular and intracellular ionized calcium is essential to life. Ca^{2+} is a conventional diffusible second messenger released inside cells by the interaction of first messengers with plasma membrane receptors. However, it can also penetrate directly into cells to deliver information without the intermediation of first or second messengers. Ca^{2+} is controlled by reversible complexation to specific proteins, which could be pure Ca^{2+} buffers, or which, in addition to buffering Ca^{2+} , also decode its signal to pass it on to targets Taurine serves as buffer to maintain equilibrium between intracellular and extra cellular ionized calcium (Idrissi 2008).

The third reason is the modulation of serotonin. The transient hypocalcemia provokes release

Table 1

Sl. No.	Village/Mandal	Month/Year	Description	Before Treatment	After Treatment	Remarks
1	Lakkireddipalli	7/2018	Hf 4 Th Calver	Downer for 10 Days	Taurocall. One Bottle, Got up after 6 Hours	Recovered
2	Palannagaripalli/Ramapuram	8/2018	H.f Cow, 3 rd Calving	Downer Since 4 Days, Mifex Given, One Per Day but No Relief	Taurocall One Bottle Given, Animal Got up Immediately	Recovered
3	Rachapalli/Lakki Reddi Palli	8/2018	Hf Cow, 5 th Calving	Mifex 3 Bottles, One for 3 Days, No Response	Taurocal, One Bottle, Got Up Immediately	Recovered
4	Avulavandla Palli/Rayachoti	8/2018	She Buffaloe, 3 rd Calving	Recurrent Hypocalcemia, Given Oral and Intravenous Calcium for 2 Days but No Response	Taurocall One Bottle, Got Up After 6 Hours but No Recurrence	Recovered
5	Devapatla/Sambepalli	8/2018	Jersey, 2 nd Calver	Bottle of Cal Mag No Response	Taurocall One Bottle, Got Up Immediately	Recovered
6	Peddakodivadlapalli/Sambepalli	8/2018	Jersey, 2 nd Calver	Downer after One Day Calving, Mifex One Bottles for 2 Days But Recurrece	Taurocal L One Bottles Got Up Immediately, No Recurrence	Recovered
7	Kathivandlapalli/Sambepalli	8/2018	Hf Heifer	Downer for 8 Days, Mifex, Mecolabin, Tonophaphan for 8 Days No Relief	Taurocal One Bottle No Response but after 2 nd Injectin Animal Normal	Recovered
8	Gundrevandlapalli/Sambepalli	8/2018	Hf 3 rd Calving	Pregnant Downer for One Week, Conventional Treatment Gave No Relief	Taurocal Got Up after 24 Hours	Recovered
9	Gundrevandlapalli/Sambepalli	8/2018	Hf 2 nd Calver	Downer for 3 Days, Conventional Treatment Failed	Taurocal C 2 nd Injection On 2 nd Day Got Up	Recovered
10	Cherukuvandlapalli/Sambepalli	8/2018	Hf Cow	Pain, Shievering Milking	Taurocal Relived	Recovered
11	Chakrayapet	8/2018	She Buffaloe, 2 nd Calving	Persistent Hypocalcemia. no Relief After Infusion of 4 Bottles	Taurocal One Bottle Relieved the Persistency	Recovered
12	Kavalivandla Palli-Chinnamandem	8/2018	Hf 2 nd Calver	Downer Since 10 Days 2 Bottels of Mifex was Given but No Response	Taurocal 2 Bottels of Mifex was Given but No Response	Not Recovered
13	Gollapalli/Ramapuram	9/2018	Hf 4 th Calver	Downer for 4 Days, Mifex 2 Bottles for 3 Days, No Relief	Taurocal One Bottle, Cow Got Up Immediately	Recovered
14	Madhavaram/Raychoti	9/2018	Hf 4 th Calver	Downer 4 Days	Taurocal L Got Up after 4 Hours	Recovered
15	Gopalapuram/Kalakada	9/2018	Hf Cow, 3 rd Calver,	Relived Dystokia, Downer, for 10 Day, Mifex @ One Bottles Per Day for 7 Days but No Relief	Taurocal One Bottle, Cow Got Again, and Became Downer, 2 nd Tec Given Animal Got and Became Study.	Recovered
16	Devaptla/Sambepalli	9/2018	Jersey Heiver, Calved, One Month, Persistent Hypocacemia	4 Bottles Calboral but Hypocacemia Recurrence	Taurocal One Bottle Up Immediately but Nourrence Reoc	Recovered

17	Mallaruvanlapalli/ Sambepalli	9/2018	Jersey, 4 th Calver	Downer Since 12 Hours, Mifex, Tonophosphan, Mecobalmin, Got Up, Became Downer after 3 Days	Taurocal, Got Up Immediately No Recurrence	Recovered
18	Bodireddigaripalli /Chinnamandem	9/2018	Hf 2 nd Calver	Preparturient Downer, Conventional, Gave No Relief	Taurocal Got Up after 4 Hours	Recovered
19	Yerramorapalli/ Sambepalli	9/2018	Hf 3 rd Calver	Downer for 6 Days	Taurocal 2 Bottels, No Response	Not Recovered
20	Yerramoreem Palli- Sambepalli	9/2018	Hf 2 nd Calver	Animal Calved with Twins and Downer 4 Bottels of Myfex was Given No Response	Taurocal 2 Bottels of was Given No Response	Not Recovered
21	Danduvandlapalli/ Sambepalli	10/2018	Jersey. 3 rd Calving	Downer for 24 Hour. No Relief with Conventional Treatment	Taurocal, The Cow Got after 2 nd Injection	Recovered
22	Nadimicherla – Kalakada	10/2018	Hf 2 nd Calver	Preparturient Downer Since 4 Days, Conventional Treatment Given for 3 Day No Response	Taurocal 2 Bottle Given Animal Got Up after 6 Hours	Recovered

of mammary derived parathyroid hormone-related protein (PTHrP) PTHrP, which can then act on bone to release calcium for transfer into milk: a process that is regulated by serotonin. Calcium and serotonin are positively correlated on the day of parturition in both Holstein and Jersey breeds (Samantha *et al.* 2016). Taurine modulates serotonin production and maintains serum calcium concentration (Wheler *et al.* 1967)

The fourth reason is induction of energy- Taurine deficiency-mediated impairment of complex I activity also affects energy metabolism, largely through elevations in the NADH/NAD⁺ ratio, which regulate energy metabolism by feedback inhibiting key dehydrogenases. The citric acid cycle is very sensitive to increases in the NADH/NAD⁺ ratio, as three NADH sensitive enzymes (α -ketoglutarate dehydrogenase, isocitrate dehydrogenase and citrate synthase) are subject to inhibition by elevations in the NADH/NAD⁺ ratio. For example, oxidation of pyruvate by the taurine deficient heart falls, as elevations in the NADH/NAD⁺ ratio inhibits pyruvate dehydrogenase activity and causes a deficiency in pyruvate, arising from the massive conversion of pyruvate to lactate (Schaffer *et al.* 2016).

CONCLUSION

After poor response to conventional treatment, twenty two farmers in the rural Rayalaseema region during July to October 2018, adopted new intervention. The treatment comprises infusion of 450 ml of 25% calcium Borogluconate with Taurine (Taurocal). It was observed the animals showed high energy stance and got up within 10 minutes to 12 hours. The cure rate was 86%. The possible therapeutic action of Taurine was based on calcium homeostasis, minimization of stress, serotonin modulation and energy metabolism.

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