

Post Parturient Hypomagnesemia in Ruminants

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Synonyms:

- Lactation Tetany in Cows/ Buffaloes
- Hypomagnesemic Tetany/
- Grass staggers/ Grass Tetany-Due to lush green grass feeding which is Mg deficient
- Wheat pasture poisoning – Wheat feeding causes ↓Mg & Ca but ↑K⁺ - So concurrent hypocalcemia is noticed

Definition:

- It is highly fatal metabolic disease of all classes of ruminants but reaches highest incidence in lactating cows & buffaloes,

Characterized by hypomagnesemia & in few circumstances hypocalcemia

Clinically with tetany, hyperesthesia, tono-clonic muscle spasms and resulting in acute death due to respiratory failure.

- Seen after parturition during 2nd-4th month of lactation

Epidemiology:

1. Incidence: It is a variable (0.1 to 0.3%).

2. Morbidity & Mortality

- Variable 2 – 12%
- CRF is high due to short course of the disease – dairy cattle may go up to 30%

2. Species:

- Ruminants viz. cattle, buffalo, ewes and does are affected.
- Magnesium deficiency is **uncommon** in simple stomached animals and human beings due to **adequate concentration of the element in food.**

3. Breed:

- HF is more prone compared to Jersey
- B. Taurus more prone compared to B. indicus

3. Age: Generally, **4-7 years** group is affected as Mg mobilization from bone decreases with age.

4. Sex: Mostly females are affected.

5. Physiological status:

- Both pregnant and lactating females are affected.
- Common during 2nd-4th / first 2 months month of lactation in cows and 1-4 weeks after lambing in ewes.
- The ewes with twins are more affected than singles.

6. Milk yield: High yielders are more prone to this disorder.

7. Predisposing factor: Exposure to inclement or bad weather viz cold, windy, wet weather

8. Season: Hypomagnesemia is common during cold winter due to depression of appetite and a negative energy balance during bad weather.

It is known as winter hypomagnesemia seen in housed lactating dairy cattle out wintered in bad inclement weather and on poor quality feed

9. Economic importance: Although effective treatment is available, the case fatality rate is high because of short course of the diseases.

Epinephrine release will cause precipitous fall in serum Mg

Etiology:

- This condition is caused by hypomagnesemia and the etiology is multifactorial which is due to -

1. Dietary deficiency of magnesium:



- Grazing on young green grass / lush pasture which is poor in Mg and Na and rich in K and nitrogenous fertilizers causes sudden increase in ammonia, impairing its absorption (Grass tetany).
- Presence of competing cations such as potassium and sodium that affect either herbage magnesium status or magnesium absorption.
- Excess feeding of young green cereal crops which are deficient in Mg and Na and rich in K (Wheat pasture poisoning).
- Forages grown on soil deficient in Mg. Highly leached, acid, sandy soils are usually deficient in Mg where as black and brown soils are rich in Mg.
- Reduced availability of Mg to plants due to high 'K' and 'Al' in acidic soil.
- Heavy application of potash, ammonia and nitrogen rich fertilizers also reduce uptake of Mg by crops.
- Partial or inadequate nutrition or energy intake during dry season.
- Starvation for 24 – 48 hrs. due to bad weather, transportation etc. leads to hypomagnesaemia due to low DM and energy intake.

2. Decreased absorption / unavailability of magnesium:

- Reduced absorption due to digestive disturbances such as diarrhea.
- Presence of chelating agents in diet like alpha ketobutyric acid.
- Diet rich in protein or nitrogen (High Ammonia in rumen – chelation and unavailability).
- High K content of diet reduces availability of Mg to animal.
- Pastures with concentration of K > 30 mg/kg DM and nitrogen > 40 g/kg DM are considered hazardous.
- Increased absorption with readily available carbohydrates
- Increased volatile fatty acids provide active transport of Mg across the rumen wall
- Grasses with high ratio of K : Ca & Mg.

3. Drain of Mg or increased loss of Mg:

- The excess loss of Mg through milk (i.e. 0.12 gm per lit of milk) also results in hypomagnesemia.
- Increased demand of Mg for growth of fetus.



- ❖ *The worst combination of causative factors is low dietary intake (lush pasture) in recently calved cows during a spell of cold windy weather.*
- ❖ Chronic subclinical hypomagnesemia can increase the susceptibility of milk fever and Downer cow syndrome

Pathogenesis

- Clinical cases have Mg conc. less than 1 mg/dL
- Mg has influence on the impulse transmission at the neuro-muscular junction
 - Affects the release of Ach at N-M junctions
 - Affects the sensitivity of the motor end plates
 - Affects the activation of choline esterase system
- Decreased Mg → Inhibit the release & action of PTH → Genesis of concurrent ↓ed Ca leading to tetany & convulsions

Clinical Signs - Disease occurs in three different forms, acute, sub-acute & chronic form

Acute:

- Sudden in onset
- While grazing, animal suddenly ceases to graze & adopt a posture of unusual alertness and appear discomfort
- Twitching muscles and ears
- Severe hyperesthesia and even slight disturbances precipitate attacks of continuous bellowing, frenzied galloping, and occasional aggression.
- Staggering gait and the animal falls due to tetany of the limbs and is rapidly followed by clonic convulsions for one minute. During the convulsive episodes there is:
 - Opisthotonos
 - Nystagmus
 - Champing of the jaws
 - Grinding of teeth
 - Frothing at the mouth
 - Pricking of the ears
 - Retraction of the eyelids.



- Between such episodes, the animal lies quietly, however a sudden noise (or) touch may precipitate another attack.
- There will be high rise of temperature (104 – 105⁰F), pulse and respiratory rates
- Increased heart rate with increased absolute intensity of the heart sounds and can be heard from a distance.
- Death usually occurs within 5 mins to 1 hour and death is due to respiratory failure.
- Mortality rate is high because there is no time for therapy
- The response to treatment is generally good, if treatment is undertaken early.

Sub-acute form:

- Onset is gradual or slow over a period of 3-4 days.
- There will be slight inappetence, wild facial expression and exaggerated limb movements.
- Spasmodic urination and defecation are characteristic
- Decreased rumen motility
- Decreased milk yield
- Muscle tremor and mild tetany of hind limbs and tail with an unsteady staggering gait
- Accompanied by retraction of head and trismus/ lock jaw condition.
- But sudden movement/ noise/ restraining/ insertion of needle may precipitate violent convulsions.
- Animal may recover spontaneously within few days (or) progress to recumbency stage.
- Treatment is usually effective but there is marked tendency to relapse/ reoccur.

Chronic form:

- Many animals in an affected herd may have decreased Mg and don't show any clinical signs but may die suddenly
- A few of such cases may show a vague syndrome like dullness, unthriftiness, poor appetite and drop in milk production
- In lactating cows, there may be paresis and a milk fever like syndrome and will be poorly respond to Ca therapy
- This form can also be seen in animals which recover from sub-acute form.

Diagnosis



(i) History:

- Excess feeding of green lush pasture or young cereal forages grown on Mg deficient soil,
- Early lactation, high milk yield and
- Exposure to cold windy weather.

(ii) Clinical signs:

- Hyperesthesia, tetany, convulsions and sudden death in recently parturiated animals.

(iii) Clinical pathology:**a) Serum examination**

Serum Mg	:	Normal levels	- 1.7 – 3 mg/dL
		Sub clinical hypomagnesemia	- 1 - 2 mg/dL
		Clinical/ Tetanic hypomagnesemia	- <0.5 mg/dL
Serum Ca	:	Reduces to	<5 – 8 mg/dL
Serum P	:	May or may not be reduced	Increased
Serum K	:	High (hyperkalaemia).	

b) Cerebro spinal fluid (CSF) Mg concentration

- Useful and reliable than serum conc.
- In normal cases both serum & CSF Mg conc. is same @ 2mg/ dL
- In subclinical hypomagnesemia CSF Mg conc. reduces to 1.84 mg/dL
- But in tetanic cows with hypomagnesemia the CSF conc. reduces to 1.25 mg/dL

c) Urine Mg concentration

- Herd diagnosis is done by estimating urinary Mg conc.
- Urine magnesium concentrations below 1.0 mg/dL indicate danger of tetany
- Qualitative test is done by Xylidyl blue test-based on the reaction of Mg with xylidyl blue-I (as chelator) at alkaline pH, yielding a purple colored complex.

Good and immediate response to Mg treatment is the confirmatory diagnosis

Differential Diagnosis:**In bovines****1. Acute lead poisoning:**

- History of access to lead.



- Blindness
- No response to Mg therapy

2. Rabies:

- History of dog bite
- Ascending paralysis.
- Absence of tetany
- No response to Mg therapy

3. Nervous form of ketosis:

- Absence of tetany
- Hypoglycemia and ketonuria
- Response to glucose therapy

4. Strychnine poisoning:

- History of access to strychnine.
- Rare in ruminants.

5. Chlorinated hydrocarbon poisoning:

- History of access to poison
- No complete response to Mg therapy.

6. Surra:

- Occurrence during monsoon.
- Blood smear positive for *Trypanosoma spp.*
- Response to quinapyramine / diminazene treatment

7. Bovine spongiform encephalitis

- By PCR

In Goats

- Hypocalcemia
- Phlaris poisoning
- Staggers syndrome

Treatment:

- For acute cases, there is no time for treatment, so only sub acute cases may be treated.



Specific treatment:

- The solution containing Ca and Mg gives satisfactory results.
- Safest general recommendation is to use a combination of 25% CBG+ 5% Mg hypophosphite preparation like Mifex/Miphocal/Glamag/Lactomag @ 1 ml/kg body wt. IV for 3 – 4 days is reported to be effective (@ 500 ml i.v for cattle & 50 ml i.v for sheep)
- Followed by s/c injections of concentrated solution of Mg salts like 20% MgSO₄ @ 200 ml for cattle

Direct Mg therapy

- 20% MgSO₄ (@ 200 – 300 ml i.v – Rapid increase in serum Mg within 3-6 hours but over dose has serious side effects like induction of cardiac dysrhythmias/ medullary depression/ respiratory failure (or)
- 3.3% Magnesium lactate @ 200-300 ml i.v (or) s.c – Have prolonged effect & cause less tissue injury (or)
- 15% Magnesium gluconate @ 200-400 ml i.v (or) s.c – slow increase in serum levels and will have sustained release for longer duration
- Rectal infusion of 30 g of Mg Cl₂ dissolved in 100 ml solution has excellent effect dissolved in 100ml water has also good effect
- Rectal infusion of 30g MgCl₂ has good effect

Symptomatic treatment:

- Use of sedatives to control convulsions.
- Inj. Chlorpromazine HCl @ 1 mg/kg body wt i.v.
- Sequil/ diazepam can be advised

MgSO₄ Saturated solution

- Intra venous route – Euthanasia
- Oral administration – Saline purgative
- Topical application – Smoothing agent
- Intra uscular/ Subcutaneous administration – Muscle relaxant

How to manage Mg over dose/toxicity?



- If signs of excessive slowing/ increase in heart rate or respiratory distress then, the injection should be stopped immediately.

If necessary, calcium solution is injected.

How chronic subclinical hypomagnesemia increases susceptibility to milk fever

- **Hypomagnesemia reduces –**
The production and secretion of PTH.
Hydroxylation of vit. D in the liver and
Target organ sensitivity to physiological effects of PTH and 1, 25-DHCC

Control:

- Dietary supplementation as **Mg.oxide** commonly but other salts like **Mg.carbonate/ Mg.sulphate** also can be used.

In lactating cattle during normal periods @ 3g/kg of DM

During danger periods-87% Mg oxide (Magnesite) feeding/ drenching @ 60g/ day

- Daily feeding of Mg. oxide @ 120g is safe & effective but over dose may cause diarrhea with much mucous
- For Sheep @ 7 g daily (or) 14g every second day
- Mg phosphate @ 53g/day is also safe & effective
- But all the Mg supplements are impalatable, so these have to be mixed with molasses in equal parts.

Different forms of Mg supplementation

- Mg & salt blocks
- Spraying of a mixture containing magnesite & molasses on hay. Provide hay along with greens.
- Pellets – Mg rich pellets mixed with other grains/ molasses
- Drenching of Mg oxide/ MgCl₂ by using drenching gun can be practiced in lactating cows before leaving the milking parlor
- Heavy Mg bullets – placed in reticulum which liberates small amounts of Mg @ 1g/day consistently
- 4 bullets at a time can be administered in acute hypomagnesemia



- Top dressing of pasture with magnesium rich fertilizers e.g. calcined magnesite @ 1125 kg / hectare (or) Magnesic lime stone @ 5600 kg/ hectare is satisfactory.
- Foliar dusting & spraying with 2% solution of MgSO₄ at fortnight interval.
- Application of very finely grounded Mg oxide @ 30 kg/ hectare before commencement of grazing – effective in cattle
- Dairy animals should be provided with comfortable shelter during winter.
- Provision in drinking water – 500g MgSO₄ (or) 420 g of Mg chloride hexahydrate to 100L of drinking water during risk period is effective
- Management of Pasture fields
 - Encourage the development of legumes rich in Mg in place of tetany prone pastures
 - Grazing low risk animals on high-risk pastures is recommended
 - Cultivate cool-season grasses with high Mg content like Rye grass/ cultivate Tall fescue
- Provide shelter in order to protect from prevailing winds
- In cadence can be reduced by provision of some grain hay/ roughage grazing
- Periods of fasting during bad weather should be avoided especially in lactating animals to avoid seasonal hypomagnesemia.

