Anemia and Blood Transfusion in Ruminants

Dr.P.Selvaraj

BVSc., PGDBM(Anim.Sci.), MVSc., Ph.D (Clin.Med)., Dip.Regen.Med., Fellow. Regen. Med(USA).,

Professor of Clinical Medicine

Tamilnadu Veterinary and Animal Sciences University,

Chennai, Tamilnadu.

AgMOOC Course on
Fluid Therapy and Management of Clinical Syndromes in Cattle and Small Ruminants

Unit : Anemia and Blood Transfusion in Ruminants
Lesson : 1

Anemia in Ruminants

Dr.P.Selvaraj
BVSc., PGDBM (Anim.Sci.), MVSc., Ph.D (Clin.Med)., Dip.Regen.Med.,Fellow. Regen. Med(USA).,
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Tamilnadu Veterinary and Animal Sciences University, Chennai, India

Anemia & its Classification

- Anemia is the reduction of blood oxygen and it is characterized by a decrease in hematocrit,erythrocyte mass and / or hemoglobin concentration leading to tissue hypoxia.
- It is classified either based on the ensuing pathogenic mechanisms, as:
  - *Hemorrhagic Anemia*
  - *Hemolytic Anemia*
  - *Anemia caused by the decreased production of erythrocytes*
- Based on the regenerative response of bone marrow its characterized as
  - *Regenerative Anemia*
  - *Non-regenerative anemia.*

Mechanism

- Presence of hypoxia in renal erythropoietin producing cells, as a consequence of anemia, dynamically alters the concentration of circulating erythropoietin.
- Erythropoietin induces proliferation and differentiation of erythroid progenitors, leading to red cell production.
- Regeneration is mainly observed in acute blood loss or in hemolytic anemia.
- It is unlikely in cases where anemia is related to a chronic disease or by impaired erythrocyte production by bone marrow.

Causes of blood loss anemia in Sheep, Goat and Cattle

- **Ectoparasites**
  - Linognathus spp
- **Gastrointestinal tract**
  - Haemonchus concortus
  - Mecistocirrus spp
  - Fasciola hepatica
  - Paramphistomum cervi
- **Abomasal ulceration**
- **Hemorrhagic bowel syndrome**
- **Winter dysentery**
- **Respiratory tract**
  - Caudal vena cava thrombosis and pulmonary embolism
- **Genitourinary tract disease**
  - Enzoonotic hematuria
- **Others**
  - Injuries
  - Tumor
- **Hemostatic disorders**
- **Carbon tetrachloride**

Causes of hemolytic anemia in Sheep, Goat and Cattle

Infectious Agents

- Babesia spp
- Theileria spp
- Anaplasma spp
- Trypanosoma spp
- Mycoplasma spp
- Stephanofilarial dermatitis
- Yellow lamb disease
- Bacillary hemoglobinuria
- Leptospira sp

Toxic Agents

- Allium spp
- Brassica spp
- Ipomoa carnea
- Long-acting oxytetracycline
- Copper
- Zinc
- Arsenic
- Lead

Other Causes of Anemia

Nutritional deficiency

- Copper
- Selenium
- Phosphorus

Immune Mediated Conditions

- Vaccination
- Bovine colostrum fed to sheep
- IMHA

Causes of anemia of decreased erythrocyte production in ruminants

- **Nutrition deficiency anemia**
  - Cobalt / Folate
  - Iron
- **Anemia of chronic diseases**
  - Lumpy skin disease
  - Mycoplasma paratuberculosis
  - Chronic toxicity
  - Bluetongue
- **Anemia secondary to bone marrow dysfunction or dysplasia**
  - Neoplasia
  - Bovine neonatal pancytopenia

Clinical manifestations and severity

- Mucous membrane pallor
- Exercise intolerance
- Tachypnea and / or dyspnea are the most commonly signs
- Heart auscultation reveals an increased heart rate as well as functional murmurs due to blood cell turbulence disturbances
- Severity of clinical signs is negatively related to the chronicity of anemia and positively to the amount of blood loss.

Diagnosis – Cont'd:

- Hemorrhage is evidenced during physical examination as epistaxis, hematuria and melena or denoted by the presence of ecto-parasites.
- Hemolysis is manifested by icterus, splenomegaly and abnormal urine color due to hemoglobinuria or bilirubinuria.
- In case of hemostatic disorders, petechiae and ecchymoses or body cavity effusions are observed.

Diagnosis:

- Chronic diseases as well as bone marrow insults are manifested by mild symptoms such as weight loss and decrease of weight gain in lambs, reduction of foraging or grazing, reduced exercise tolerance and subcutaneous edema.

- Severe acute hemorrhage or blood destruction is usually presented with a more severe clinical picture, even sudden deaths, depending on the cause of anemia

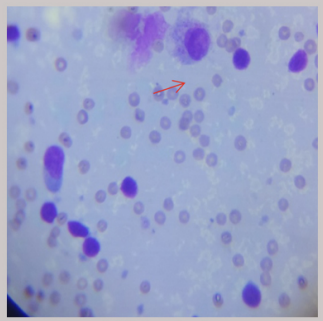
Scoring of Anemia:

- Scoring systems of the severity of clinical anemia as manifested by mucous membrane pallor have been developed in ruminants.
- Widely used is called FAMACHA (FAO, 1998).
- Initially developed to identify small ruminants with anemia caused by haemonchosis.

Laboratory evaluations

Blood testing

- Complete blood count (CBC)
- Agglutination testing
- Fecal examination
- Microscopy for the detection of parasites,
- Presence of occult blood
- Microbiology including molecular techniques for the detection of causative agents of the underlying disease



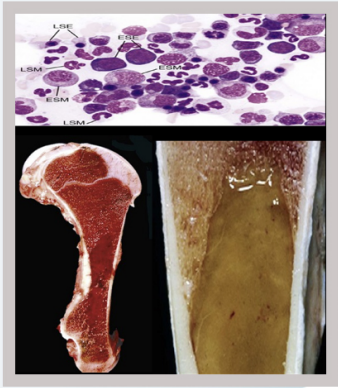
LN Aspirate-
Schizont stage of Theileria sp

Urinalysis

- Indication for urinalysis in anemic ruminants is the red or dark brown color in urine.
- Urine sediment microscopy can reveals the presence of red blood cells (hematuria).
- Red color of the supernatant after urine centrifugation either due to the presence of hemoglobin or myoglobin should be further differentiated by chemical analysis
- Certain microorganisms can also be detected in urine employing either microscopy or molecular techniques.

Bone marrow evaluation

- Used to determine the regenerative response.
- If there is an increased cellularity in bone marrow, anemia is regenerative, while if there are few cells with morphological abnormalities, bone marrow dysfunction and dys-erythropoiesis as well as non-regenerative anemia is more likely to occur.
- Bone marrow samples can be used for detection of causative agents of underlying diseases



Additional Testing

- Serological and molecular techniques are widely used for the etiological diagnosis of diseases that are associated with anemia in ruminants.

- Chemical analysis is used for the detection of heavy metals and toxins in biological material as well as in feed and water.

Thank you