For Vet Professionals only

Face2Vet

A Clinical Update

Volume 7 Issue 5

Differential Diagnosis of Hemo-Parasitic Infections in Livestock

Hemoparasitic infections are caused by parasites infecting the blood of animals. They can be caused by hemoprotozoans like Trypanosoma *spp*, Theileria *spp* and Babesia *spp* or Rickettsiae like Anaplasma *spp.* The disease is mainly transmitted by arthropod vectors. They pose a serious threat to the livestock population in terms of mortality, reduced milk yield and lowered draft power. The clinical manifestation of the disease varies from fever, anorexia, anaemia, threatened abortion and death in acute form of disease. Comparative and differential diagnosis amongst these diseases often poses a challenging task for the practitioner.

Incidence

Hemoparasitic diseases have a global distribution. In India too, the disease is distributed across the sub-continent. The hot and humid climate in India is favourable for growth, multiplication and survival of arthropod parasites which serves as vector for these hemoparasites. The exotic and crossbred cattle are known to be highly susceptible group, while the indigenous cattle possess inherent resistance. Incidences in farm animals reported in cattle, sheep, goat, camel, horses and pigs.

Aetiology and Vectors

Hemo-parasitic diseases	Causative Organisms	Target Species	Vector	Vector species
Protozoal Diseases				
Babesiosis	*Babesia bigemina* and *Babesia divergens*	Cattle and Buffaloes	Ticks	*Rhipicephalus microplus* and *Rhipicephalus annulatus*
	Babesia motasi and *Babesia ovis*	Sheep and Goats	Ticks	*Rhipicephalus bursa* and *Haemaphysalis bispinosa*
Theileriosis	*Theileria parva, Theileria annulata, Theileria orientalis* and *Theileria mutans*	Cattle and Buffaloes	Ticks	*Rhipicephalus appendiculatus* and *Hyalomma anatolicum*
	Theileria lestoquardi (formerly Theileria hirci) and *Theileria ovis*	Sheep and Goats	Ticks	*Hyalomma spp, Haemophysalis spp* and *Rhipicephalus spp*
Trypanosomiasis	*Trypanosoma evansi* and *Trypanosoma vivax*	Cattle and Buffalo	Hematophagous flies	Tabanus, Stomoxys and Haematobia *spp*
Rickettsial				
Anaplasmosis	*Anaplasma marginale, Anaplasma centrale, Anaplasma bovis* and *Anaplasma caudatum*	Cattle and Buffalo	Ticks	Dermacentor and Ambyloma *spp* of ticks
			Hematophagous flies	Tabanus *spp* of flies
			Sucking lice	Haematopinus and Linognathus *spp* of sucking lice
	Anaplasma ovis	Sheep and Goat	Sheep keg	*Melophagus ovinus*

Overview

	Babesiosis	Theileriosis	Trypanosomiasis	Anaplasmosis
Synonyms	Piroplasmosis, Cattle tick fever, Texas fever, Red water fever	East coast fever, Egyptian fever, Corridor disease, Tropical Thelieriosis, Mediterranean coast fever	Surra, Dourine, Tibersa	Gall Sickness
Organism	Intracellular protozoa	Intracellular protozoa	Extracellular protozoa	Obligate intracellular Gram negative bacteria
Typical Symptomology	High fever	High fever	Intermittent fever	Fever
	Anemia	Lymphadenopathy	Anemia	Progressive Anaemia
	Hemoglobinuria	–	Rapid loss of condition terminating in death	–
Site for parasite identification	Inside RBCs	Inside WBCs (lymphocytes) and RBCs	Outside RBCs (In bloodstream) except - *Trypanosoma cruzi* (obligate intracellular)	Inside RBCs
Incubation period (days)	14 – 21	7 – 21	4 – 13	7 – 35

Clinical Signs

	Babesiosis	Theileriosis	Trypanosomiasis	Anaplasmosis
Cattle and Buffaloes	**Acute form** • Fever > 41° C (106° F). • Inappetence, depression, polypnea, weakness and reluctance to move. • Hemoglobinuria [Fig-1] (red water), urine is dark red to brown in color and produces a stable froth. • Anemia [Fig-2] and Hemolytic jaundice, particularly in prolonged and severe cases. • Diarrhoea may occur. • Muscle wasting, tremors and recumbency in advanced cases. • Metabolic acidosis can be present • During the fever stage, pregnant cattle can abort and bulls may become sterile for 6 to 8 weeks. • Cerebral babesiosis is manifested by incoordination, followed by posterior paralysis or mania, convulsions and coma. **Sub-Acute form** (in young calves) • Mild fever • Hemoglobinuria is absent • Spasm of anal sphincter causing the passage of feces with great force in a long, thin stream 'pipe-stem' feces.	• First clinical sign is enlargement of lymph nodes [Fig-3] in the area draining the site of tick attachment (parotid, prescapular, pre-femoral) • One or two days later, there is fever, depression, anorexia and drop in milk • In later stages, there may be nasal and ocular discharges [Fig-4], dyspnoea and generalized lymph node enlargement and splenomegaly. • In severe cases, diarrhoea occur sometimes with dysentery but usually only late incourse of disease. • Emaciation, weakness and recumbency leads to death from asphyxia in 7 - 10 days. • Terminally, there is often a frothy nasal discharge. • Occasional cases of brain involvement occur and are characterized by circling, hence 'turning sickness' or cerebral theileriosis.	• The main clinical findings are intermittent fever, progressive anaemia, edema of dependent body parts, dullness, listlessness, loss of body condition despite a good appetite [Fig-5], nasal and ocular discharge [Fig-6], abortion and infertility. • In late stages, there are marked nervous signs including marked paraplegia, paralysis, delirium and convulsions. • Surra is invariably fatal in camels and horses, with death occurring in days or months. • In camels mostly chronic forms occur and may last for three years. The main signs are weakness, alopecia, pale mucus membranes, oedema of legs and abortion in females. • In mild conditions in Cattle clinical signs include reduction in milk yield and capacity for work, irregular estrus, a high rate of abortion and stillbirth, and poor semen quality in bulls. • In severe form in Cattle nervous signs and high mortality is seen.	**Per-acute cases** • Sudden onset of high fever, anaemia, icterus, severe dyspnea and death, often within 24 hours. • Affected animals are often hyperexcitable and tend to attack attendants just before death. • Pregnant cows frequently abort. • In convalescent bulls there may be depressed testicular function for several months. **Sub-Acute form** (in young animals) • Rectal temperature rises rather slowly and rarely to above 40.5° C (105° F). It may remain elevated or fluctuate with irregular periods of fever and normal temperature alternating for several days to two weeks. • In-appetence • Pale and jaundiced mucous membranes • No hemoglobinuria • Death may occur • Anemia is caused by extensive erythrophagocytosis initiated by parasite induced RBC damage.
Sheep and Goat	Anemia, fever, icterus, and hemoglobinuria	• Fever, anorexia, weight loss, lymphadenopathy, respiratory signs (coughing, nasal discharge, dyspnea), anaemia, icterus and diarrhoea and abortion in pregnant ewes. • *Theileria hirci* is highly pathogenic with almost 100 percent mortality	• Natural infection is generally mild or asymptomatic	In sheep and goats, infection is usually sub-clinical, but in some cases, particularly goats, severe anemia may occur, and a clinical picture similar to that found in cattle may be seen. Severe reactions of this type in goats are most frequent when the animals are suffering from concurrent disease. Goats may show hyperexcitability and may bite inanimate objects.

Fig:1 Goat with Babesiosis showing hemoglobinuria

Fig:2 Cattle affected with Babesiosis having pale mucous membrane

Fig:3- : Enlarged prescapular lymph node in cattle with Theileriosis

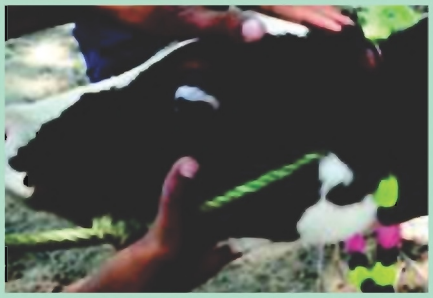

Fig-4: Exopthalmos in calf due to Theileriosis

Fig-5: Wasting due to chronic Trypanosomiasis

Fig-6: Conjunctivitis and corneal opacity in buffalo due to Trypanosomiasis

Fig-7: Edema of neck & jowl in buffalo affected with Trypanosomiasis

Fig-8: Debility in Anaplasmosis

Fig-9: Sunken eyes and pale mucous membrane due to Anaplasmosis

(Courtesy: Intas Polivet)

Diagnosis

	Babesiosis	Theileriosis	Trypanosomiasis	Anaplasmosis
Vector presence	Severe tick infestation	Severe tick infestation	Presence of biting flies on animal body and in the surrounding	Presence of ticks / Hematophagus flies
Clinical Signs	• Anaemia and jaundice • Hemoglobinuria • In subacute form- No hemoglobinuria and presence of pipe stem faeces	• Lymph node enlargement initially at the area draining the site of tick attachment and later it is generalised • Small subcutaneous nodules • Conjunctivitis and corneal opacity may be seen	• Progressive Anaemia • Oedma of dependent parts of body [Fig-7] • Lesions on skin due to bite of flies	• Progressive anemia • Weakness with laboured breathing.
Temperature	Fever >41° C (106° F) for several days before other signs appear	Fever >42° C appears 1 -2 days after lymph node enlargement	Intermittent fever	Temperature rises slowly and rarely above >40.5° C (105° F)
Hemoglobinuria	Present	Present	Absent	Absent
Lymph node Enlargement	No	Yes	Yes	No
Ocular/ Nasal discharge	No	Ocular Discharge may be present	Ocular and Nasal Discharge may be present	No
Abortion	Yes	Yes	Yes	Abortion or Transplacental transfer of Infection
Nervous Signs	Cerebral babesiosis- posterior paralysis, convulsions and coma	Cerebral theileriosis or turning sickness- circling movements	In severe form- paraplegia, paralysis, delirium and convulsions	Hyperexcitable, attacks even the attenders in advance stage
Hematology	• Severe Anemia • Decreased Hemoglobin levels • Reduction in platelet numbers • Depressed fibrinogen content in blood	• Leukopenia • Thrombocytopenia • Anemia	• Decrease in RBC count and PCV volume • Neutrophilia • Lymphopenia • Hypoglycemia	• Decreased RBCs and Hemoglobin level • Immature red cells are more in blood smears

Identification of Causative Organism				
Microscopic Examination	• Giemsa-stained smears of capillary blood **Presence of Parasite** ***Babesia bovis-*** • Small parasite, located centrally in RBCs • Measures approximately 1–1.5 µm long and 0.5–1.0 µm wide • Found as pairs that are at an obtuse angle to each other or in single ring form ***Babesia divergens*** • Small parasite and is very similar morphologically to *B. bovis.* • Obtuse angled pairs are located at the rim of RBCs ***Babesia bigemina*** • Pear-shaped, but many diverse single forms are also found. • Much bigger parasite (3–3.5 µm long and 1–1.5 µm wide) • Found as pairs at an acute angle to each other or almost parallel [Fig-8]	• Giemsa Stained lymph node biopsy smears for identifying schizonts • Giemsa-stained blood smears for identifying piroplasms **Presence of Parasite** • Lymphnode smear- Multinucleate intralymphocytic and extracellular schizonts [Fig-11] • Piroplasms- Found in different shapes- ring, signet-ring, comma, round, oval and rod shape [Fig-12] • *Theileria annulata* piroplasms are mainly- round and oval • *Theileria parva* piroplasms are mainly comma and rod shaped	• Wet blood films or Giemsa stained smears • Direct identification of the parasite in lymph node biopsy smears from fine needle aspirates or oedema fluid • Concentration methods- microhematocrit centrifugation, quantitative buffy coat technique, and mini-anion-exchange centrifugation technique **Presence of Parasite** • Monomorphic thin trypomastigote parasite with slender body, free flagellum and a kinetoplast • Parasites will be present outside the RBCs [Fig-13]	• Giemsa Stained blood smear **Presence of Parasite** • Homogeneously staining blue-purple inclusions 0.3–1 µm in diameter. • *Anaplasma marginale* are at the margin of the infected RBCs [Fig-12] • *Anaplasma centrale* inclusion bodies are located at the centre of RBCs
PCR- based techniques	Positive samples should have PCR products of the expected size (170 bp for *Babesia bigemina* and 291 bp *Babesia bovis*) similar to those of positive controls	Amplification of 721 bp is observed in positive cases	PCR technique for tryps is more effective in camel and equids then in cattle	PCR product of 458 bp for *Anaplasma marginale*
Detection of Antibodies Serological Tests	ELISA and cELISA detection of antibodies to *Babesia sp.*	Indirect immunofluorescent antibody test, ELISA	Indirect immunofluorescent antibody test, ELISA, Card agglutination test, Immune trypanolysis test	ELISA, cELISA, Complement fixation test (CFT) or card agglutination tests

Important Differential points :

- **Babesiosis and Anaplasmosis both result in dark colour urine but hemoglobinuria occur only in Babesiosis. Further, both can be differentiated on examination of blood smears.**
- **Oedema of body parts occurs in both Trypanosomiasis and Theileriosis but high fever along with enlarged lymph nodes of scapular and femoral regions occurs in Theileriosis.**
- **Hypoglycaemia occur mostly in Trypanosomiasis**

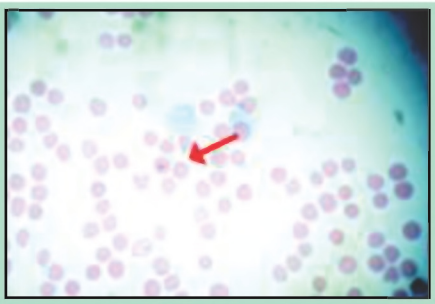

Fig-10: Mircoscopic detection of *Babesia sp.*

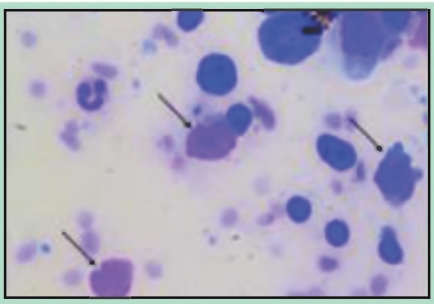

Fig-11: *Thieleria annulata* schizont in lymphoblastoid cell

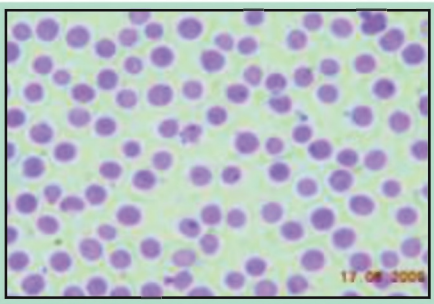

Fig-12: *Theileria annulata* in RBCs

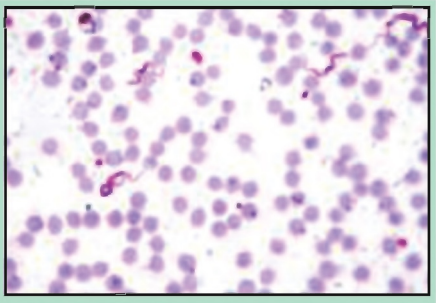

Fig-13: Blood smear showing *Trypansoma evansi*

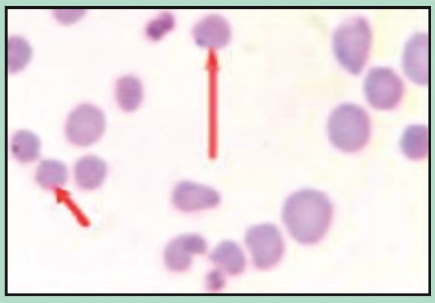

Fig-14: Intraerythrocytic form of *Anaplasma marginale*

(Courtesy: Intas Polivet)

Treatment and Control

	Babesiosis	Theileriosis	Trypanosomiasis	Anaplasmosis
Treatment	Diminazene diaceturate: 0.8-1.6 gm/100 kg b.wt IM Imidocarb diproprionate: 1mg/kg b.wt SC	Buparvaquone: 2.5 mg/kg b.wt IM, 2 doses- 48 hours apart	Isometamidium chloride: 0.25–1 mg/kg b.wt IM (ruminants) and 10 mg/kg IV (equines, camelids, 2–3 times weekly) Diminazene diaceturate: 3.5–7 mg/kg b.wt IM (ruminants)	Imidocarb: 5 mg/kg b.wt IM twice, 7 days apart Enrofloxacin: 12.5 mg/kg b.wt SC twice, 48 hours apart
Recommended therapy	Diminazene diaceturate Imidocarb **(Nilbery and Imizet)**	Buparvaquone **(Zubion)** Buparvaquone with Fruosemide **(Zubion-F)**	Isometamidium **(Nyzom)**	Imidocarb **(Imizet)**
Dosage and Administration	**Nilbery:** 3.5 -7mg/kg b.wt deep IM route only **Imizet:** 1 ml / 100 kg b.wt IM **Prevention:** 2.5ml/100kg b.wt IM	**Zubion/Zubion-F** – 1ml/20 kg b.wt IM deep into neck repeated after 48 hours	**Nyzom:** 0.25 – 0.5 mg/kg b.wt Prevention: 0.5 – 1 mg/kg b.wt Deep IM only	**Imizet:** 2.5 ml / 100 kg b.wt. IM
Supportive therapies	**Antipyretic-** Meloxicam and Paracetamol **(Melonex Plus Inj.):** Large Animals- 30ml/400kg b.wt IM, Small Animals- 1ml/10kg b.wt IM **Hematinic-** Iron, Folic Acid, Hydroxycobalamin **(Feritas Bolus):** 2 boli for 10-15 days PO **Multivitamin-** B-Complex **(Tribivet Inj.):** Large Animals- 5-10ml, Small Animals- 0.5-2ml IM or IV **Fluid Support IV-** Dextrose, Sodium Chloride, Potassium Chloride, Calcium Chloride, Sodium Lactate **(Intalyte):** Large Animals- 500-2000ml IV, Small Animals- 25-100ml IV **Fluid Support Oral-** Sodium Chloride, Potassium Chloride, Calcium Propionate, Magnesium Sulphate fortified with Vitamin A, D_3 and E **(Intalyte Oral):** Dissolve 30gm in 1 litre water, give twice daily.			
Control	**Tick Control-** a) Ivermectin **(Neomec/Neomec LA):** 1ml/50kg b.wt IM b) Moxidectin **(Moxidecton):** 1ml/50kg b.wt. IM **Anti-tick dips-** Deltamethrin **(Tinix):** To be diluted and used as spray or dip, 2-4ml/litre of water **Cattle shed:** 10ml in 5 litre water per 100m^3 surface			

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