# Pre and post therapeutic cardiopulmonary evaluation of bovines with chronic Trypanosomosis

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## Abstract

Bovine trypanosomosis is regarded as one of the most prevalent haemoprotozoan diseases, with a large vector population. Despite of various reports on clinical signs, haemato-biochemical changes and therapeutic trails in bovines, limited information was available on exhibition of cardiopulmonary affections during the chronic trypanomsosis in bovines. During the study period, twenty-four bovines with chronic trypanosomosis and cardio-pulmonary abnormalities were selected and given injection of quinapyramine sulphate and quinapyramine chloride along with supportive medications. Confirmation of the trypanomsosis was done by demonstration of organisms in the stained blood smears. Tachycardia, cardiac murmurs, muffled heart sounds, arrhythmias, anemia, low albumin, and elevated LDH levels were present before therapy and the post-treatment evaluation by the 28$^{th}$ day of treatment, these symptoms had subsided. However, following treatment there was no alterations in the elevated serum levels of creatine kinase myocardial band isoenzymes and serum gamma glutamyl transferase. Presence of dyspnea, tachypnea, bradycardia, positive jugular pulsation and atrial fibrillation were the observed prognostic factors in chronic trypanosomosis bovines.

**Keywords:** Bovines, *Trypanosoma evansi*, cardiac function, pulmonary signs

# Introduction

*Trypanosoma evansi*, which is mechanically spread by tabanid fly bites among the animals in India. It is one of the deadly wasting diseases known as "surra" that affect both domestic and wild animals. *Trypanosoma evansi* can infect a range of hosts and produce a variety of clinical symptoms, according to Sivajothi et al. (2019). The pathological changes depend on the host type, the nutritional status of the animals, and the geographic location. These characteristics make surra both multispecies and a polymorphic disease in livestock. It can cause oxidative changes in the host and certain electrocardiographic changes in buffaloes (Sivajothi and Reddy, 2017). Most farm animals first develop subclinical infections before developing strong and clinical infections as a result of a number of stressors, such as work, transportation, inclement weather, malnutrition, and other coexisting infections (Chanie et al., 2013, Gautam et al., 2021). Although cardiopulmonary alterations in bovines with trypanosomosis are essential for the physician to assess the prognosis, these alterations have not been thoroughly documented. Hence, present study was carried out to record the cardiopulmonary signs and their presence during the pre and post therapeutic monitoring periods which is essential in determining the prognosis and useful in alterations in the therapeutic regimen of chronic trypanosomosis in bovines.

# Materials and methods

From January 2022 to December 2023, the current study was conducted at the Department of Veterinary Medicine, College of Veterinary Science-Proddatur, Andhra Pradesh, India (Latitude and longitude coordinates are: 14.752805, 78.552757). 24 bovines (18 buffaloes and 6 cattle) diagnosed as chronic trypanosomosis with cardiopulmonary abnormalities were selected for the study. All the animals included in the present study were belongs to the individual farmers and periodical examination of the individual animal was done at research institution and the individual farmers home as per the available conditions. All the animals were administered with injections of quinapyramine sulphate and quinapyramine chloride (3:2 w/w) at 3.5 mg/kg body weight subcutaneously, flunixin meglumine at 2 mg/kg body weight intramuscularly, and a multivitamin injection (Tribivet) @ 10 ml intramuscularly; oral administration of a liver tonic fortified with yeast and vitamin (Brotone Vet) @ 50 g twice a day orally; syrup 3D RED is a nutritional feed supplement @ 30 ml twice daily orally (Bhosale et al., 2020; Singh et al., 2021). All of the animals in the present study were weighed from 300 and 420 kg. Four animals were died during the study period, and the clinical signs, haemato-biochemical findings, electrocardiographic and echocardiographic findings were used to derive the prognostic factors. On the day of presentation, an average of seven days after therapy, and an average of twenty-eight days after therapy, post-treatment cardiac and respiratory function was assessed.

Clinical examination (dyspnea, tachypnea, tachycardia, cardiac murmurs, muffled heart sounds, and cardiac arrhythmia); hemato-biochemical examination (albumin, hemoglobin, LDH, GGT, and CK-MB); electrocardiographic examination (abnormalities of the atrial and ventricular contractions waves); and echocardiographic examination (LVIDd, LVIDs, IVSd, IVSs, LVPWd, and LVPWs) was carried out to evaluate cardiac and respiratory function. Clinical examination of the animals was carried out to for the cardio -pulmonary signs as per the standard clinical procedures. Five millilitres of blood was collected from the jugular vein and loaded into vacutainers containing EDTA to carry out the complete blood count; 5 ml of blood was collected in clot activator vacutainer for separation of serum and it was utilised for the estimation of serum biochemical parameters. Electrocardiography was done by keeping the animals in standing position bipolar base apex lead system was carried out by consider as lead I as standard. All electrocardiography parameters were recorded on a single channel electrocardiographic machine with paper speed 25 mm/sec, voltage of 10 mm/mV. The right arm electrode was attached to middle of the neck (Figure.1) and the left arm electrode is placed over the apex of the heart just behind the elbow (Figure.2). The electrodes were placed using alligator clips with a gel contact. In order to ensure good adherence to the skin, the skin was cleaned with alcohol prior to the application of the gel. The recordings were analyzed for the P wave, the QRS complex, the PR interval, the ST segment, the QT interval and the T wave. Heart rate was calculated according to the R-R interval in lead-1 (Reddy et al., 2015). By keeping the animals in standing position, using Esaote My Lab 40 VET ultrasonographic scanner with a phased array probe with a variable frequency ranging from 2 to 3.5 MHz in right parasternal long axis view, B mode and M mode echocardiography were performed (Braun et al., 2001; Buczinski, 2009). The SPSS 23.00 version was used to statistically analyze the results.

# Results and Discussion

The microscopic examination of the Giemsa-stained blood smears confirmed the presence of *Trypanosoma evansi* infection. Dyspnea, tachypnea, tachycardia, cardiac murmurs, muffled heart sounds, and cardiac arrhythmia were found by clinical examination. These symptoms were present by the seventh day of therapy and vanished by the twenty-eighth day of the examination after therapy. The haemato-biochemical analysis of the animals after treatment presented in the Table-1.

**Table-1**. Post therapeutic assessment of haemato-biochemical findings in bovines with trypanosomosis

| S. No. | Parameters | Day of examination | Apparently healthy buffaloes (10) (Mean±S.E.) | Bovines with trypanosomosis (Mean±S.E.) |
|---|---|---|---|---|
| 1. | Haemoglobin (g/dL) | 0th Day | 10.08 ± 0.59 | 7.91±0.41 |
| | | 7th Day | | 8.12±0.76 |
| | | 28th Day | | 9.04 ±0.29 |
| | | P value | | 0.26 NS |
| 2. | Albumin (mg/dL) | 0th Day | 2.94 ± 0.23 | 1.89±0.27 |
| | | 7th Day | | 2.28±0.19 |
| | | 28th Day | | 2.91±0.31 |
| | | P value | | 0.47NS |
| 3. | Lactate Dehydrogenase (IU/L) | 0th Day | 298.8 ± 12.2 | 509.2±37.72 |
| | | 7th Day | | 501.66±41.82 |
| | | 28th Day | | 231.27 ±16.06 |
| | | P value | | 0.31NS |
| 4. | Gamma Glutamyl Transferase (IU/L) | 0th Day | 17.26 ± 0.82 | 44.08 ±5.77 |
| | | 7th Day | | 49.09±3.02 |
| | | 28th Day | | 36.62±6.02 |
| | | P value | | 0.036* |
| 5. | Creatinine Kinase-Myocardial Band (IU/L) | 0th Day | 68.71 ± 6.18 | 506.58±52.02 |
| | | 7th Day | | 518.22±28.8 |
| | | 28th Day | | 302.77±41.29 |
| | | P value | | 0.031* |

*Significant (P<0.05), **Highly significant (P<0.01) and NS-Non significant (P>0.05); [ab]Columns bearing different superscripts differ significantly

Table-2. Post therapeutic assessment of cardiac function by echocardiography in bovines with trypanosomosis

| S. No | Parameters | Day of examination | Apparently healthy Animals (10) (Mean±S.E.) | Bovines with Trypanosomosis (Mean±S.E.) |
|---|---|---|---|---|
| 1. | LVIDd (cm) | 0th Day | 6.12[a] ± 0.21 | 6.63±0.37 |
| | | 7th Day | | 6.71±0.19 |
| | | 28th Day | | 6.69[b]±0.38 |
| | | P value | | 0.037* |
| 2. | LVIDs (cm) | 0th Day | 4.18[a] ± 0.32 | 4.79±0.39 |
| | | 7th Day | | 4.81±0.51 |
| | | 28th Day | | 4.91[b] ±0.41 |
| | | P value | | 0.021* |
| 3. | IVSd (cm) | 0th Day | 2.21[a] ± 0.09 | 2.44±0.23 |
| | | 7th Day | | 2.46±0.32 |
| | | 28th Day | | 2.48[b]±0.27 |
| | | P value | | 0.065NS |
| 4. | IVSs (cm) | 0th Day | 2.82[a] ± 0.08 | 3.02±0.32 |
| | | 7th Day | | 3.06±0.37 |
| | | 28th Day | | 3.08[b]±0.29 |
| | | P value | | 0.047* |
| 5. | LVPWd (cm) | 0th Day | 2.16[a] ± 0.17 | 2.33±0.18 |
| | | 7th Day | | 2.40±0.24 |
| | | 28th Day | | 2.31[b]±0.31 |
| | | P value | | 0.0389* |
| 6. | LVPWs (cm) | 0th Day | 2.98[a] ± 0.21 | 3.19±0.19 |
| | | 7th Day | | 3.28±0.31 |
| | | 28th Day | | 3.32[b]±0.42 |
| | | P value | | 0.031* |

*Significant (P<0.05), **Highly significant (P<0.01) and NS-Non significant (P>0.05)

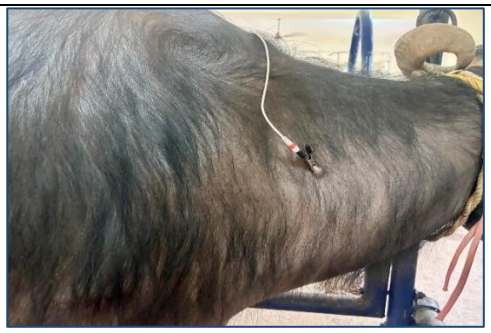

Fig-1: Placing of right arm (RA) electrode

Fig-2: Placing of left arm (LA) electrode

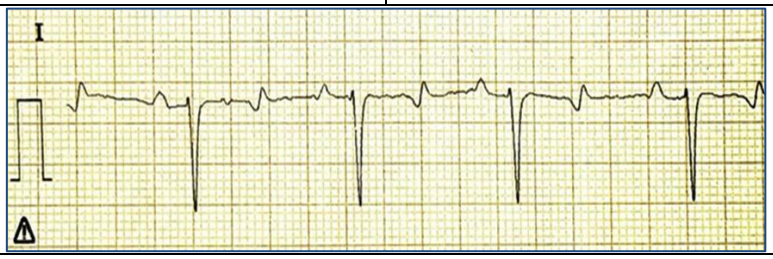


Fig-3: Biphasic T wave & AV Block with heart rate of 68 bpm (Lead I, paper speed 25 mm/sec, calibrated 10 mm/mV)

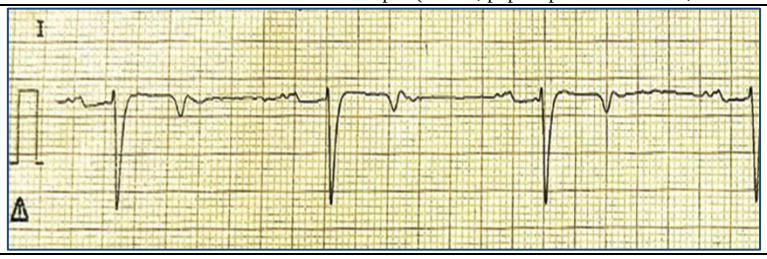


Fig-4: Biphasic T wave and atrial flutter with heart rate of 46 bpm (Lead I, paper speed of 25 mm/sec, voltage of 10 mm/mV)

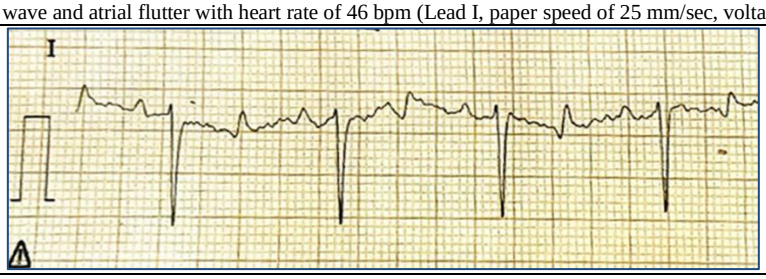


Fig-5: Arrhythmia with heart rate of 71 bpm (Lead I, paper speed of 25 mm/sec, voltage of 10 mm/mV)

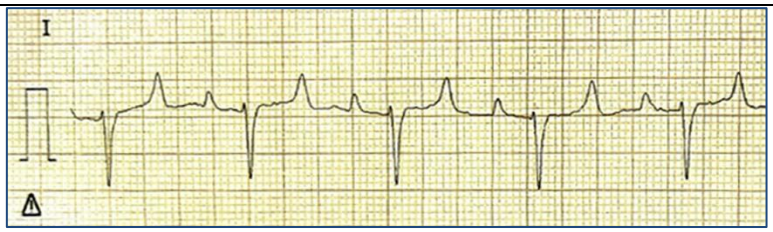


Fig-6: Tall T wave and P wave with heart rate of 71 bpm (Lead I, paper speed of 25 mm/sec, voltage of 10 mm/mV)

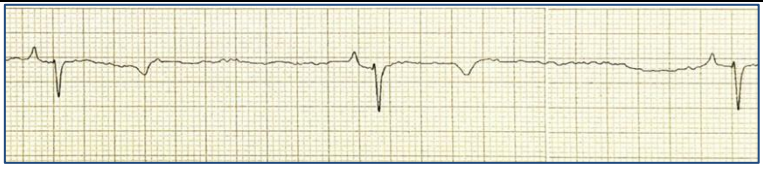

Fig-7: Atrio ventricular block and bradycardia with heart rate of 26 bpm (Lead I, paper speed of 25 mm/sec, voltage of 10 mm/mV)

**Table-3**. Parameters in bovines died due to trypanosomosis

| S. No | Parameters | Apparently healthy buffaloes (10) (Mean±S.E.) | Bovines with trypanosomosis (4) (Mean±S.E.) | P value |
|---|---|---|---|---|
| 1. | Dyspnea | - | 4 | - |
| 2. | Tachypnea | - | 2 | - |
| 3. | Bradycardia | - | 4 | - |
| 4. | Positive jugular pulsation | - | 3 | - |
| 5. | Haemoglobin (g/dL) | $10.08^{b} \pm 0.59$ | $5.08^{a} \pm 0.31$ | 0.002** |
| 6. | LDH (IU/L) | $298.80^{a} \pm 12.2$ | $768.18^{b} \pm 70.82$ | 0.003** |
| 7. | GGT (IU/L) | $17.26^{a} \pm 0.82$ | $92.27^{b} \pm 12.08$ | 0.003** |
| 8. | CK-MB (IU/L) | $68.71^{a} \pm 6.18$ | $1608.2^{b} \pm 80.27$ | 0.001** |
| 9. | Atrial fibrillation /Flutter | - | 75.00% (3/4) | - |
| 10. | LVIDd (cm) | $6.12^{a} \pm 0.21$ | $6.78^{b} \pm 0.76$ | 0.001** |
| 11. | LVPWs (cm) | $2.98^{a} \pm 0.21$ | $3.29^{b} \pm 0.52$ | 0.001** |
| 12. | IVSs (cm) | $2.82^{a} \pm 0.08$ | $3.12^{b} \pm 0.09$ | 0.001** |

**Highly significant (P<0.01); $^{ab}$Columns bearing different superscripts differ significantly

The mean haemoglobin revealed 7.91±0.41 g/dL, 8.12±0.76 g/dL, 9.04±0.29 g/dL; serum albumin level 1.89±0.27 mg/dL, 2.28±0.19 mg/dL, 2.91±0.31 mg/dL; lactate dehydrogenase (LDH) was 509.2±37.72 IU/L, 501.66±41.82 IU/L, 231.27±16.06 IU/L; gamma glutamyl transferase (GGT) was 44.08±5.77 IU/L, 49.09±3.02 IU/L, 36.62±6.02 IU/L; creatinine kinase-myocardial band (CK-MB) was 506.58±52.02 IU/L, 518.22±28.80 IU/L, 302.77±41.29 IU/L on $0^{th}$ day, $7^{th}$ day and $28^{th}$ day of post therapeutic examination. Improvement on the haemoglobin, serum albumin levels was increased after therapy and noticed the there is no significant difference from the control group. Reduction in the serum lactate dehydrogenase levels was noticed from the $0^{th}$ day to $28^{th}$ day and it was no significant difference from the control group. Reduction in the serum gamma glutamate transferase and creatinine kinase myocardial band levels was noticed from the $0^{th}$ day to $28^{th}$ day of post therapy but it was not significant from the $0^{th}$ day levels and still it was significantly differed from the control group of animals.

Before initiation of therapy, some of the animals showed the electrocardiographic abnormalities including P wave abnormalities, T wave abnormalities, alterations in the cardiac rhythm and varies in the heart rate (Figure 3 to Figure 7). During the post-treatment observation period, some of the animals were showed the presence of electrocardiography abnormalities like bradycardia and arrhythmia. Table-2 shows the results of the therapeutic evaluation of cardiac function using echocardiography. Cardiac chamber measurements were taken on various examination days, and the mean values were compared with the measurements taken on the $0^{th}$, $7^{th}$, and $28^{th}$ days of the examination (Left Ventricular internal diameter during diastole (LVIDd); Left Ventricular internal diameter during systole (LVIDs), Inter ventricular septal diameter during diastole (IVSd), Inter ventricular septal diameter during systole (IVSs), Left Ventricular post wall diameter during diastole (LVPWd); Left Ventricular post wall diameter during systole (LVPWs). On the first day of presentation, all the parameters showed a significant elevation, and even after therapy, the reduction was not statistically significant with in the group and it was statistically significant from the control group.

Four animals were died in the current study (with the range duration from 12 to 21 days from the disease diagnosis), and the parameters were compared to those of other cows that appeared to be in good health in order to determine the prognostic factors that are listed in Table-3. These factors included low hemoglobin, high serum cardiac enzyme levels, atrial fibrillation, bradycardia, left ventricular internal diameter during diastole, left ventricular post wall thickness during systole, and interventricular septal thickness during systole.

The treatment plan followed in the present study was consistent with earlier references, such as Giordani et al. (2016) and Singh et al. (2021), which treated trypanosomosis in bovines by subcutaneously administering quinapyramine sulphate and quinapyramine chloride at a dose of 3 to 5 mg/kg body weight in cases of bubaline trypanosomosis. The post-treatment evaluation in this study documented the study-specific remarkably haemato-biochemical changes, such as anemia, low albumin levels (Sivajothi et al., 2015). On the day of presentation, seven days later, and twenty-eight days later, a post-therapeutic evaluation of animals revealed the dyspnea, tachycardia, tachycardia, cardiac murmurs, muffled heart sounds, and arrhythmias were all checked for in the clinical examination used to evaluate cardiac-pulmonary affections after treatment. By the $28^{th}$ day of treatment, the majority of the animals in this study had improved clinically, as evidenced by the elimination of certain clinical symptoms.

There was no significant difference between the apparently healthy and bovines with trypanomsosis affected bovines on the $28^{th}$ day after therapy, according to the post-therapeutic haemato-biochemical examination. Additionally, there were no significant changes in the serum levels of LDH, GGT, and CK-MB by the $28^{th}$ day of therapy, which are indicative of the presence of constant elevation of cardiac muscle enzymes during the study period, and a significant difference between the apparently healthy and trypanosomosis-infected

bovines. On the first, seventh, and twenty-eighth days of the post-therapeutic evaluation period, post-treatment ECG showed that atrial fibrillation and ventricular premature complexes were still present. On the $0^{th}$, $7^{th}$, and $28^{th}$ days following therapy, post-treatment echocardiography showed a significant change in the echocardiographic parameters LVIDd, LVIDs, IVSd, IVSs, LVPWd, and LVPWs, respectively. On the $28^{th}$ day following therapy, there was no discernible difference between the apparently healthy and trypanosomosis-affected bovines.

The heart's histopathological analysis revealed discontinuity of the muscle layers, hyaline degeneration, hemorrhages in the cardiac muscles, and an increase in elastic fibers. In their experimental studies, Sivajothi et al. (2014) observed hyaline degenerative changes and hemorrhages in the heart muscles of rats infected with *Trypanosoma evansi*. These findings were ascribed to the parasites' use of glucose and oxygen for growth and multiplication. They also proposed that the parasite's toxins or immune reactions might be the source of additional myocardial developmental alterations. Hypoglycemia and anemia may be the cause of degenerative heart changes.

Bradycardia, positive jugular pulsation and atrial fibrillation were the observed prognostic factors in trypanosomosis-infected bovines. Before initiation of therapy, these elements will assist the clinician in evaluating the therapeutic response and examining the clinical outcome. The evaluation of prognostic factors in bovines with chronic trypanomsosis secondary to abnormal cardiac-pulmonary function was not previously covered in any literature. According to Collinson et al. (2007), serum biomarkers can be used to evaluate cardiovascular dysfunction and damage. Serum enzyme measurements were used to evaluate cardiovascular dysfunction in the current investigation.

**Conclusion**

Preset study provides the salient cardiopulmonary signs and parameters to be consider while carrying out the therapy by assessing the prognosis.

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