Original Research

Study of Clinical Markers and Biochemical Parameters in Theileriosis Affected Cattle Treated with Arteether

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Abstract

The present research work was done with the objective to study the clinical markers and biochemical parameters of arteether against theileriosis in cattle. Total 67 suspected cattle of theileriosis were screened based on blood smear examination and lymph node biopsy. The animals were also studied for clinical markers associated with theileriosis. After treatment with buparvaquone and arteether total protein, albumin and globulin showed significant improvement. Blood urea nitrogen and creatinine levels were significantly increased in theileriosis affected cattle. Buparvaquone treated animals showed increase in blood urea nitrogen (BUN) and creatinine level affecting the kidneys and arteether treated cattle showed significant improvement. AST, ALT and total bilirubin were increased in theileriosis affected cattle and significant improvement occur after treatment with buparvaquone and arteether. Arteether showed 66.66% efficacy as compared to buparvaquone which observed 100% efficacy.

Key words: Arteether, Biochemical Parameters, Buparvaquone, Clinical Markers, Theileriosis

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Introduction

Theileriosis is an arthropod transmitted economically important haemoprotozoan disease of tropical and subtropical regions of the world which belongs to Apicomplexa group. Hemoprotozoan infections represent the major problem in cattle breeding due to severe economic losses which leads to lowered animal production and increase in both susceptibility to other secondary bacterial infections and mortalities. The recent estimate of 498.7 million US doller per annum has been calculated as the cost of tick transmitted bovine diseases' in India (Kumar *et al*., 2018). However, Devendra (1995) reported the annual loss of 800 million US dollar due to tropical theileriosis in India.

Theileria spp. is an intracellular parasite that infects both wild and domestic bovidae family all over the world and some species also infect small ruminants. They are transmitted with *Ixodid* ticks and have complex life cycle in vertebrate as well as invertebrate hosts (OIE, 2014). Globally, the important species causing bovine theileriosis are *T. annualata* and *T. parva*. Life cycle of *Theileria* spp. involves cyclical development in ticks to form sporozoites which are then injected into mammalian host, in which they develop into schizont in leucocyte and then piroplasm in erythtrocyte. *T. annulata* affects cattle and it is transmitted transstadially with the help of *Ixodid* ticks. Tropical theileriosis is characterized by high fever, generalized weakness, weight loss, reduced appetite, conjunctival petechiae, enlargement of superficial lymph nodes, anemia, lateral recumbency, diarrhea and dysentery (Constable *et al*., 2017).

Materials and Methods

The animals were selected from Teaching Veterinary Clinical Complex, Instructional Livestock Farm Complex, COVAS, Parbhani and nearby villages from Parbhani District, Maharashtra, India. The study was carried out for six months from January-June 2019. Total 67 suspected cattle were examined in different age, sex and breed randomly belonging to different localities in Parbhani district. The screening was done based on the clinical signs like high body temperature, enlargement of lymph nodes, conjunctiva petechiae, tick infestation and haemoglobin level more than 6 g/dl. Total 12 positive cases for theileriosis (n=6) in both the groups confirmed by usning blood smear examination (Fig. 1) and lymph node biopsy method (Fig. 2) which were examined for clinical and biochemical studies.

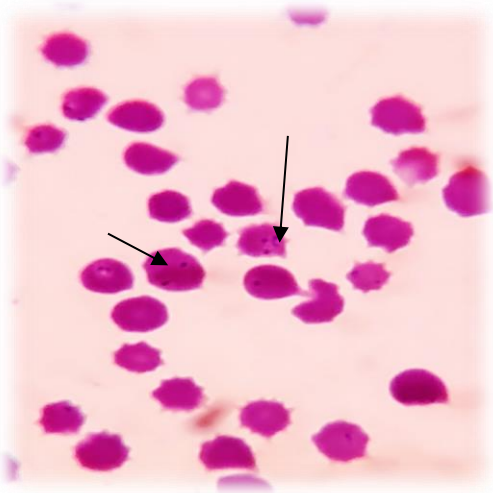

Fig. 1: *Theileria annulata* piroplasm in RBC's in cattle (Giemsa's stain 100x)

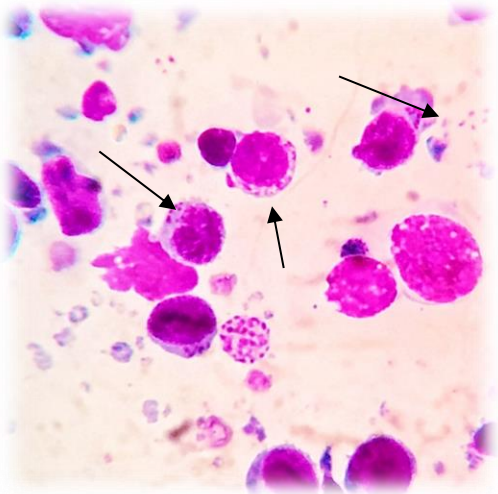

Fig. 2: Koch's blue bodies in lymphocyte of lymph smear aspirate from *Theileria annulata* positive cattle (Giemsa's stain 100x)

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Collection of Samples

The serum samples were collected from theileriosis affected cattle for biochemical analysis. For biochemical analysis, blood from jugular vein of animal was collected in plain vaccuatainers with clot activator at room temperature and allowed to clot. After 1 to 2 hours, the tubes were centrifuged at 3000 rpm for 20 minutes. Clear serum samples were carefully drawn and transferred to clean, dry sterilized serum collecting tubes. These tubes were kept at -20^{o}C. Blood samples from jugular vein were collected at day 0th, day 7th and day 21st for biochemical investigation. Biochemical investigation was done with the help of Chem-7 automated biochemical analyzer.

Treatment

Twelve clinically positive cases of theileriosis were distributed in two equal groups (n=6). Group I was treated with inj. buparvaquone @ 2.5 mg/kg body weight once and Group II was treated with inj. arteether @ 5 mg/kg body weight intramuscularly for three consecutive days.

Statistical Analysis

The statistical analysis of the data was subjected Two Factor Factorial Experiment using WASP (Web Agri Stats Package) version 2.0 by ICAR. The values were represented as Mean ± Standard Error.

Results and Discussion

In current study, total 67 cattle suspected for theileriosis were screened on the basis of clinical signs like conjunctival petechiae, enlarged lymph nodes, presence of ticks on body and pyrexia. –conjunctival petechiae (77.61 %), enlarged lymph nodes (53.73 %), presence of ticks on body (92.53 %) and high body temperature (91.04 %) were the major clinical signs noted at the time of screening are depicted in Table 1.

Table 1: Clinical markers during screening of cattle for theileriosis

Symptoms	Number of animals screened (Total animals = 67)	Percentage occurrence (%)
Conjunctival petechiae	52	77.61%
Enlargement of lymph nodes	36	53.73%
Ticks on the body	62	92.53%
High temperature (<103°F)	61	91.04%

Clinical Markers of Theileriosis

Out of the total 67 suspected animals 15 were confirmed for theileriosis on the basis of blood smear examination. The signs noticed in 15 theileriosis confirmed cases are as given below. The signs found in theileriosis affected cattle were as conjunctival petechiae 100.00 %, enlargement of lymph node 80.00 %,

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presence of ticks infestation revealed 93.33 %, high temperature 100.00 %, respiratory distress found to be 73.33 %, nasal discharge 33.33 %, diarrhoea 46.66 % and reduced appetite was seen in 60.00 % cases.The present findings were in accordance with Al- Emarah *et al*. (2012) and Saravanan *et al*., (2017).The clinical markers of theielriosis are depicted in Table 2.

Table 2: Clinical markers of theileriosis affected cattle

Symptoms	No. of Positive Animals (Total animals = 15)	Percentage Occurrence (%)
Conjunctival petechiae	15	100.00%
Enlargement of lymph nodes	12	80.00%
Ticks on the body	14	93.33%
High temperature (<103°F)	15	100.00%
Respiratory distress	11	73.33%
Nasal discharge	5	33.33%
Diarrhea	7	46.66%
Reduced appetite	9	60.00%

Biochemical Parameters

In present study, the theileriosis affected cattle were examined for biochemical alterations. Total protein and albumin level in treatment group I treated with buparvaquone and group II arteether showed non-significant, but apparent improvement on day 7 post treatment and significant improvement on day 21st post treatment as compared to '0'day before treatment. The decline in total protein and albumin might be due the harmful effect of toxic metabolites of *Theileria* spp. and due to liver failure or it may be attributed to extra -vascular proteinaceous fluid in body cavities due to infected lymph nodes resulting in edema (Khan *et al.*, 2011).

Treatment group I showed non-significant improvement in mean globulin on day 7 and day 21 after treatment as compared to '0'day before treatment. In group II, non-significant improvement was observed on 7th day and significant improvement on 21st day post treatment was observed as compared to '0' day before treatment. Increase in globulin may reflect the body immune response to parasites (Singh *et al*., 2017 and Hamed *et al*., 2016). The treatment group I showed non-significant difference in BUN level. In group II, non-significant, but apparent change in BUN was observed on day 7th and significant improvement was observed on 21st post treatment as compared to '0' day before treatment. The BUN level increased on 7th and 21st day post treatment that indicated adverse effect of Inj. Buparvaquone on the kidney. However, in group II, treated with Inj. Arteether, BUN values decreased non significantly on day 7th after treatment and showed significant increase on 21st day post treatments compared to '0' day before treatment. It indicates better efficacy of Inj. Arteether and protective effect on kidneys. The change in BUN level was probably due to harmful effect of toxic metabolites of theileriosis on liver cells leads to impairment and alterations

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of liver and kidney enzymes (Hamed *et al*., 2016). Serum creatinine level revealed apparent change in creatinine level on day 7th and significant difference was observed on 21st day post treatment in group I indicating adverse effect of buparvaquone on kidneys. However, in treatment group II treated with Inj. arteether showed non-significant but apparent decrease in creatinine level on day 7th and day 21st post treatment. Increase in creatinine probably due to liver and kidney damage caused due to theileriosis (Somu *et al*., 2017). Result indicated good response to treatment with Inj. Arteether and hepatoprotective activity. Treatment group I, treated with buparvaquone and group II with Arteether showed significant decrease in AST and ALT level after 7th and 21st day post treatment as compared to '0' day before treatment in theileriosis affected cattle. The liver enzymes like AST and ALT showed significant increase which may be due to hepatic tissue damage that included coagulative necrosis, distortion of hepatic cord with heavy infiltration of lymphocytes in the peripheral areas indicating severe damage to hepatobiliary system due to hepatobiliary system due to hypoxia due to anemia and jaundice (Modi *et al*., 2015). Total bilirubin level in treatment group I and group II showed non-significant decrease on 7th day and significant improvement was observed on 21st day post treatment as compared to '0' day before treatment. Increase in bilirubin concentration may be related to hepatic dysfunction and hemolytic anaemia (Al-Emarah *et al*., 2012). The biochemical study showed that Arteether has at par efficacy as compared to buparvaquone in theileriosis affected cattle. The analysis of variance revealed non-significant variation in pooled mean of total protein, albumin, globulin, AST, ALT and total bilirubin in between treatment groups (I and II). However, significant variation was observed in BUN and creatinine in both groups (I and II).

Pooled mean of periods in total protein, BUN, AST, ALT and total bilirubin showed significant improvement on day 7th and day 21st post treatment as compared to '0'day before treatment and albumin and globulin showed non-significant improvement on 7th day and significant improvement on 21st day post treatment as compared to '0' day before treatment. However, pooled mean of creatinine level between periods showed non-significant variation on day 7th and 21st post treatment as compared to '0' day before treatment. Biochemical parameters of theileriosis affected cattle in arteether and buparvaquone treated groups at different interval is depicted in Table 3.

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Table 3: Biochemical parameters of theileriosis affected cattle in arteether and buparvaquone treated groups at different interval

		0 day	7 day	21 day	Pooled mean
Total Protein	Group I	6.06^{a}± 0.30	6.41^{a}± 0.10	6.81^{b}± 0.11	**6.43± 0.22**
	Group II	5.97^{a}± 0.24	6.45^{a}± 0.19	6.92^{b}± 0.11	**6.44± 0.27**
	Pooled mean	**6.01^{A}± 0.05**	**6.43^{B}± 0.02**	**6.86^{C}± 0.05**	
Albumin	Group I	2.55^{a}± 0.13	2.72^{a}± 0.14	2.96^{b}± 0.13	**2.74± 0.11**
	Group II	2.48^{a}± 0.11	2.67^{a}± 0.05	3.00^{b}± 0.06	**2.72± 0.15**
	Pooled mean	**2.52^{A}± 0.03**	**2.70^{A}± 0.03**	**2.98^{B}± 0.02**	
Globulin	Group I	3.51^{ab}± 0.25	3.68^{ab}± 0.19	3.87^{ab}± 0.17	**3.69± 0.10**
	Group II	3.48^{a}± 0.17	3.78^{ab}± 0.15	3.92^{b}± 0.13	**3.73± 0.13**
	Pooled mean	**3.50^{A}± 0.01**	**3.73^{A}± 0.05**	**3.89^{B}± 0.02**	
BUN	Group I	30.02^{ab}± 9.00	31.31^{ab}± 2.60	34.58^{ab}± 2.19	**31.97^{A}± 1.36**
	Group II	48.02^{b}± 2.77	36.98^{b}± 1.78	26.85^{a}± 0.85	**37.28^{B}± 6.11**
	Pooled mean	**39.02 C± 9.00**	**34.15^{B}± 2.83**	**30.72^{A}± 3.87**	
Creatinine	Group I	0.92^{a} ± 0.04	1.03^{ab}± 0.04	1.32^{b}± 0.04	**1.09^{A}± 0.11**
	Group II	1.33^{b} ± 0.14	1.36^{b}± 0.10	1.27^{ab} ± 0.15	**1.32^{B} ± 0.02**
	Pooled mean	**1.12± 0.20**	**1.2± 0.16**	**1.3± 0.02**	
AST	Group I	223.25^{b} ± 47.35	152.37^{a} ± 11.63	128.90^{a} ± 1.95	**168.17 ± 28.35**
	Group II	206.23^{b} ± 16.12	169.03^{a}± 10.03	132.20^{a} ± 3.71	**169.17± 21.37**
	Pooled mean	**214.74^{B}± 8.51**	**160.70^{A} ± 8.33**	**130.55^{A} ± 1.65**	
ALT	Group I	41.92^{b} ± 2.53	31.11^{a} ± 3.63	27.55^{a} ± 1.47	**33.53± 4.32**
	Group II	38.10^{b} ± 4.38	33.48^{a} ± 3.06	32.02^{a} ± 2.33	**34.53 ± 4.32**
	Pooled mean	**40.01^{B} ± 1.91**	**32.30^{A} ± 1.18**	**29.78^{A} ± 2.23**	
Total Bilirubin	Group I	1.47^{c} ± 0.20	0.93^{bc} ± 0.04	0.49^{a}± 0.06	**0.96 ± 0.28**
	Group II	1.39^{c} ± 0.19	1.03^{bc}± 0.14	1.47^{c}± 0.20	**0.91± 0.24**
	Pooled mean	**1.43^{C}± 0.04**	**0.98^{B} ± 0.05**	**1.47^{C}± 0.20**	

Conclusion

The clinical markers such as high body temperature, enlarged lymph nodes, conjunctival petichaie and ticks on body of animals are highly associated with affection of theileriosis in dairy cattle. Biochemical parameters revealed that Inj Arteether has at par efficacy with respect to total serum protein, albumin, globulin, AST, ALT and total bilirubin as compared to buparvaquone. Whereas, buparvaquone was found to possess adverse effect on BUN and creatinine levels as compared to arteether.

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