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Comparison of therapeutic efficacy of long acting oxytetracycline and enrofloxacin in anaplasmosis affected cows

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Anaplasmosis is haemorickettsial tick borne disease of cattle caused by obligate intra-erythrocytic microorganism *Anaplasma marginale* and reported worldwide but endemic in tropical and subtropical areas, transmitted biologically by infected ticks or mechanically by biting flies and contaminated fomites (Ristic, 1981). The economic losses due to tick and tick borne diseases in animals in India have been estimated to the tune of more than US$ 498.7 million per annum (Minjaw and Mcleod, 2003). Though exact estimate of economic losses due to anaplasmosis in India has not been documented but an estimated annual loss due to anaplasmosis in the US alone amounts to $100 million and includes 50000 to 100000 cattle deaths (McCallon, 1973). It is characterised by fever, weight loss, decreased milk production, pale mucous membranes, severe anemia, jaundice, brownish urine, hyper-excitability, abortion and mortality without haemoglobinemia and haemoglobinuria during acute phase of infection (Richey and Palmer, 1990). Anemia and icterus usually developed without haemoglobinemia and haemoglobinuria (Rymaszewska and Grenda, 2008), due to extravascular erythrophagocytosis in anaplasmosis. Animal recovered from clinical disease become lifelong carrier (Aubry and Geale, 2011). Therapeutic with different anti-rickettsial drugs, like oxytetracycline, long acting oxytetracycline, long acting enrofloxacin were reported to have different efficacies in the treatment of anaplasmosis (Atif *et al*., 2012; Guglielmone *et al*., 1996; Randhawa *et al*., 2011; Schroder *et al*., 1991; Suresh *et al*.,1993; Singh *et al*., 2015; Shane *et al*., 2020). So, the present comparative therapeutic trail was conducted to study the efficacy of long acting oxytetracycline and enrofloxacin in anaplasmosis affected cows.

Twelve cows found positive for *Anaplasma marginale* in giemsa stained thin blood smears were divided in two groups (n=6) each. Group-I was treated with two injections of long acting enrofloxacin (Flobac-SA) @ 7.5 mg/kg b.wt I/M at 72 hrs and Group-II treated with two injections of long acting oxytetracycline (Terramycin-L.A) @ 20mg/kg b.wt I/M at 72 hrs. Blood samples were collected in dipotassium EDTA for hematological parameters viz. hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), platelets (PLT) as per methods of Jain (1986) and erythrocytic indices viz. mean corpuscular volume (MCV), Mean Corpuscular heamoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) were derived. Blood was also collected for enzymes viz. Aspartate amino transferase (AST), alkaline phosphatase (ALP) and gamma-glutamyl transferase (GGT) estimation in heparinised (green top) vacutainers and for biochemical parameters estimation viz. total plasma protein (TPP) albumin (ALB), fibrinogen, blood urea nitrogen (BUN), total bilirubin (TBIL), direct bilirubin (DBIL) by using standard kits method. Globulin (GLB), albumin to globulin ratio (A:G) and indirect bilirubin (IBIL) were calculated. The data was analysed statistically by applying Tukey multiple range test and Paired samples t- test at 5 and 1 per cent level of significance using SPSS (Statistical Package for Social Sciences Software (version 16.0-SPSS Inc.) Therapeutic efficacy was evaluated on basis of alleviation in clinical signs, GSTBS examination for presence/ absence of *Anaplasma* and estimation of hemato-biochemical parameters on 0th, 3rd & 7th days of treatment.

Clinical indices

Clinical improvement was noticed in both treated groups by 3rd day. Out of six cows of group-I treated with long acting enrofloxacin, 4 cows started feed intake, while 2 cows were still anorectic. Whereas group-II cows treated with long acting oxytetracycline, 3 started eating while rest 3 cows were anorectic. Fever was significantly reduced in group-I cows as compared to group-II cows. Blood smears were found positive for *A. marginale* with low rickettesmia in both groups.

All cows of group-I started normal feed intake, while 4 cows of group-II regained appetite by 7th day. Subsequent blood smear examination revealed no hemorickettsia in group-I, while few hemorickettsia were still detected in group-II by day 7th.

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Table 1: Comparison of haematological parameters (Mean ± S.E) of *Anaplasma* affected cows with long acting enrofloxacin and oxytetracycline

Day	Drug	Hb (gdl^{-1})	PCV (%)	TEC ($10^6 \mu l^{-1}$)	PLT ($lac\ \mu l^{-1}$)	MCV (fl)	MCH (pg)	MCHC (%)
0th day	Enrofloxacin L.A (n=6)	4.07 ±0.60	15.00 ±1.59	2.90 ±0.36	225.83 ±31.98	48.65 ±3.46*	13.44 ±0.73	28.07 ±1.88
	Oxytetracycline L.A (n=6)	4.08 ±.23	17.17 ±1.40	3.34 ±0.13	189.17 ±23.02	46.38 ±3.12	13.05 ±0.58	28.41 ±1.04
3rd day	Enrofloxacin L.A (n=6)	5.58 ±0.50	24.83 ±2.04	4.29 ±0.31*	159.50 ±11.96	57.64 ±1.44	13.26 ±1.28	23.13 ±2.50*
	Oxytetracycline L.A (n=6)	5.32 ±0.42	21.83 ±1.01	3.53 ±0.13	161.83 ±12.30	61.99 ±2.69	15.00 ±0.93	24.41 ±1.81
7th day	Enrofloxacin L.A (n=6)	6.23 ±0.54*	26.33 ±1.69	4.75 ±0.33*	179.00 ±11.32	55.65 ±1.44	13.34 ±1.20	24.04 ±2.22
	Oxytetracycline L.A (n=6)	6.01 ±0.29	23.17 ±1.05	4.07 ±0.21	185.0 ±0.21	57.02 ±0.88	14.87 ±0.81	26.09 ±1.40

Means with different superscripts in row differ significantly ($p \leq 0.05$).
(n) refers to number of cows treated.

It was concluded that long acting enrofloxacin is more effective and faster in clearing the *A. marginale* as compared to long acting oxytetracycline. Singh *et al*. (2015) also conducted treatment trial and found that two doses of long acting enrofloxacin is an effective alternative to oxytetracycline in treatment of anaplasmosis. Randhawa *et al*. (2011) also found that two injections of long acting enrofloxacin @ 7.5 mg/kg b.wt S/C at 72 hours interval completely eliminated anaplasmosis in cattle. However, Atif *et al*. (2012) found oxytetracycline as more effective and safe in chemosterilization of persistent *A. marginale* infection in cattle. Shane *et al*., (2020) reported clinical effectiveness of long acting enrofloxacin injectable solution by a single subcutaneous @ 12.5 mg/kg for treatment of acute anaplasmosis in mature beef cows.

Effect of treatment on hematological parameters

Mean values of haematological parameters of *Anaplasma* affected cows treated with long acting enrofloxacin and oxytetracycline are shown in Table 1. Significant increase in the value of Hb was observed on 7th day post treatment in long acting enrofloxacin treated

Table 2. Comparison of biochemical parameters (Mean ± S.E) of *Anaplasma* affected cows with long acting enrofloxacin and oxytetracycline

Day	Drug	TPP (gdl^{-1})	ALB (gdl^{-1})	GLB (gdl^{-1})	A:G	BUN ($mgdl^{-1}$)	CRT ($mgdl^{-1}$)
0th day	Enrofloxacin L.A (n=6)	7.60 ±0.36	2.84 ±0.12	4.76 ±0.30	0.61 ±0.04	17.17 ±1.56*	0.74 ±0.10
	Oxytetracycline L.A (n=6)	7.66 ±0.09	3.10 ±0.04	5.01 ±0.05	0.62 ±0.01	16.17 ±1.68	0.79 ±0.09
3rd day	Enrofloxacin L.A (n=6)	7.20 ±0.27	2.98 ±0.08	4.23 ±0.24	0.72 ±0.05	15.50 ±0.99	0.71 ±0.09*
	Oxytetracycline L.A (n=6)	7.50 ±0.13	3.25 ±0.11	4.25 ±0.09	0.77 ±0.03	22.45 ±3.13	0.71 ±0.07
7th day	Enrofloxacin L.A (n=6)	7.48 ±0.16*	3.33 ±0.06	4.15 ±0.13	0.81 ±0.03	18.67 ±1.63	0.80 ±0.07
	Oxytetracycline L.A (n=6)	7.44 ±0.16	3.49 ±0.09	3.95 ±0.17	0.90 ±0.05	21.12 ±2.93	0.69 ±0.06

Means with different superscripts in row differ significantly ($p \leq 0.05$).
(n) refers to number of cows treated.

cows compared to long acting oxytetracycline treated cows. However, PCV showed non-significant increase in both the groups at 3rd and 7th day post treatment. Total erythrocyte count showed significant increase in L.A enrofloxacin treated group on 3rd and 7th day post treatment. These findings are supported by Randhawa *et al*. (2011) who found mark improvement in Hb after 8-10th day post treatment with long acting enrofloxacin. However, Suresh *et al*. (1993) reported complete cure and marked improvement in hematological parameters after intravenous administration of oxytetracycline. Shane *et al*., (2020) reported significantly higher level of packed cell volume at 7, 14, 21, and 28 days post-treatment of anaplasma affected cows with long acting enrofloxacin.

Effect of treatment on biochemical parameters

Mean values of biochemical parameters of *Anaplasma* affected cows treated with long acting enrofloxacin and oxytetracycline are shown in Table 2 and 3. Significant difference in the value of TPP was observed on 7th day post treatment in long acting enrofloxacin treated cows as compared to oxytetracycline treated cows. However, ALB, GLB, A:G, BUN, TBIL, DBIL and IBIL showed non- significant difference between the two treated groups. Fibrinogen, AST, ALP and GGT showed significant decrease in long acting enrofloxacin treated group on 3rd and 7th day post treatment. No literature could be traced regarding the effect of treatment with long acting enrofloxacin and oxytetracycline on biochemical profile in *Anaplasma* affected cows. Improvement in biochemical parameters of group-1 cows is suggestive of fast recovery. Based on the above finding, it is concluded that two doses of long acting enrofloxacin is better drug than two doses of long acting oxytetracycline in treatment of anaplasmosis in cattle.

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