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Evaluation of haematological parameters in calves with septic arthritis

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Abstract

Septic arthritis is one of the important neonatal diseases in calves. Different types of treatments have been proposed by various authors but with minimal satisfactory results. In present research, we compared the efficacy of intra-articular infusion of chitosan drug delivery impregnated with ceftiofur sodium in group I and honey in group II. Haematological parameters like Hb, PCV, TEC, TEC and DLC were estimated before and 7th, 14th, 21st and 28th day post application in calves with septic arthritis. On day of presentation Hb, PCV and TEC were lower than their respective values on day 28 and parameters gradually increased to reach normal base values on 28th day in both the groups. Significant increase in levels of TLC and neutrophil counts was noticed on day 0 which gradually declined to normalcy after initiation of treatment. Results proved that effective elimination of infection and all haematological parameters return normal after initiation of treatment.

Keywords: Septic arthritis, chitosan drug delivery impregnated with ceftiofur sodium, honey, haematology

1. Introduction

Septic arthritis is very common disease that frequently affects newborn calves. Due to the long treatment period, expensive costs and lack of effective treatment, a considerable number of animals are being slaughtered every year (Wichtel *et al.*, 2003 and Desrochers, 2004) ^[1, 2]. Lameness is a costly and widespread health problem in dairy cows subsequent to septic arthritis which possibly lead to economic losses like reduced milk production, gradual weight loss, reduced fertility and premature culling (Green *et al.*, 2002; Hernandez *et al.*, 2002; Booth *et al.*, 2004; Feldmann *et al.*, 2006; Guard, 2006) ^[3, 4, 5, 6, 7]. Bovine septic arthritis is a common and devastating clinical problem that accounts for 67.14 percent of all lameness cases in cattle (Singh *et al.*, 1989) ^[8]. Septic arthritis can result from a periarticular wound infection, inoculation of the joint by a puncture wound and by hematogenous or lymphogenous inoculation (Kofler and Martinek, 2005 and Heppelmann *et al.*, 2009) ^[9, 10]. The higher incidence of septic arthritis in calves due born in unhygienic environment, lack of disinfection of the umbilicus and inadequate intake of colostrum in the first few hours after birth (Weaver, 1997) ^[11]. One of the most common causes of culling in calves and economic losses is septic arthritis and joint diseases (Goodarzi *et al.*, 2015) ^[12]. Septic arthritis is frequently encountered in calves and which causes serious economic losses with high mortality rates, would be a more effective approach for clinical practitioners in terms of treatment and prognosis (Ibrahim , 2019) ^[13]. Dogan *et al.* (2016) ^[14] used radiography, ultrasonography and thermography to detect joint problems in calves and treatment of septic arthritis in calves was tough and time consuming, but it had good outcomes when the disease was involved only one joint and/or without other systemic disorders.

2. Materials and Methods

The study was carried out among the calves suffering from septic arthritis presented to Department of Veterinary Surgery and Radiology, Veterinary College, Hebbal, Bengaluru, College of Veterinary Science, Tirupati and Veterinary Hospital, Visakhapatnam for a period of two years from April 2017 to March 2019. Among these, twelve calves diagnosed with septic arthritis, which were found otherwise clinically fit, were selected for the study. Twelve calves were divided in to two groups of six animals each and subjected to intra-articular chitosan drug delivery system impregnated with ceftiofur sodium (100 mg) in Group I and

honey (5 ml) in Group II. Blood samples were collected by jugular venipuncture on the day of presentation and on 7th, 14th, 21st and 28th days post treatment, for the estimation of haemoglobin, packed cell volume, total erythrocyte count, total leucocyte count and differential leucocyte counts using Hematology analyzer, Horiba ABX Micros 60 supplied by M/S Horiba India Private Limited.

The data obtained on various haematological parameters at different time intervals and to find whether there is any significance difference in these parameters using one-analysis of variance (ANOVA). The differences between the two groups were obtained using two-sample t-test. The analysis was performed using SPSSv20 software.

3. Results

Haematological changes in Septic Arthritis

A. Haemoglobin (Hb)

The mean \pm S.E values of Hb content (g/dl) recorded on 0th day and 28th day in Group I and Group II were 9.13 ± 0.12 , 9.23 ± 0.13 and 9.85 ± 0.14 , 9.75 ± 0.17 respectively. There was a gradual rise in the haemoglobin content from the day of presentation to the 28th day in both the groups. But the increase was non-significant up to day 7 in group I and up to day 28 in group II. However, the changes in the values were within the normal physiological range during post treatment period in both the groups (Table 1).

B. Packed Cell Volume (PCV)

The mean \pm SE values of packed cell volume (%) recorded on 0th day and 28th day in Group I and Group II were 25.33 ± 1.14 , 25.83 ± 0.47 and 30.50 ± 0.56 , 31.33 ± 0.71 respectively. There was a gradual increase in the packed cell volume (%) from 0th to 28th day in both groups. But the increase was non-significant up to day 14 in both the groups. The packed cell volume reached its near normal base value on day 21 in group I and on day 14 in group II. However, the changes in the values were within the normal physiological range during post operative treatment period in both the groups (Table 1).

C. Total erythrocyte count (TEC)

The mean \pm SE values of total erythrocyte count (millions/ μ l) recorded on 0th day and 28th day in Group I and Group II were 4.13 ± 0.09 , 4.08 ± 0.06 and 4.70 ± 0.08 , 4.65 ± 0.14 respectively. There was a non-significant increase in the total erythrocyte count (millions/ μ l) up to day 21 in group I and up to day 14 in group II. The total erythrocyte count reached its near normal base value on day 28 in group I and on day 14 in group II. However, the changes in the values were within the normal physiological range during post operative treatment period in both the groups (Table 1).

D. Total leukocyte count (TLC)

The mean \pm SE values of total leukocyte count (thousands/ μ l) recorded on 0th day and 28th day in Group I and Group II were 11.11 ± 0.19 , 10.81 ± 0.18 and 8.08 ± 0.06 , 7.95 ± 0.15 respectively. The values were significantly higher on the day of presentation when compared to their respective values on day 28 in both the groups. At subsequent intervals a gradual decline in mean total leukocyte count was observed in

both the groups. The values returned to the near normal reference value on day 21 in group I and on day 14 in group II (Table 2).

E. Differential leucocyte count (DLC)

a. Neutrophils

The mean \pm SE values of neutrophils (%) recorded on 0th day and 28th day in Group I and Group II were 68.17 ± 0.65 , 66.00 ± 0.57 and 32.50 ± 0.61 , 33.67 ± 0.49 respectively. There was a significant decrease in the neutrophil count from 0th day to 28th day in group I and up to 21th day in group II (Table 2).

b. Lymphocytes

The mean \pm SE values of lymphocytes (%) recorded on 0th day and 28th day in group I and group II were 24.17 ± 0.79 , 25.67 ± 0.42 and 61.83 ± 0.60 , 60.67 ± 0.61 respectively. There was a significant increase ($P < 0.05$) in the lymphocyte count from 0th day to 28th day in both the groups. The lymphocyte count reached the normal baseline values by the 28th day in both the groups (Table 2).

c. Monocytes

The mean \pm SE values of monocytes (%) recorded on 0th day and 28th day in group I and group II were 5.33 ± 0.33 , 5.17 ± 0.30 and 3.33 ± 0.21 , 3.50 ± 0.34 respectively. There was non-significant decrease in the monocyte count up to day 14 in group I and up to day 7 in group II. The monocytes count reached the normal baseline values by the 28th day in both the groups (Table 2).

d. Eosinophils

The mean \pm SE values of eosinophils (%) recorded on 0th day and 28th day in group I and group II were 2.33 ± 0.2 , 3.17 ± 0.16 , and 2.33 ± 0.21 , 2.17 ± 0.16 respectively. There was a non-significant fluctuation in the eosinophil count from 0th day to 28th day in both the groups. However, fluctuations were within the normal physiological limits (Table 2).

4. Discussion

The mean haemoglobin content, packed cell volume and total erythrocyte count on the day of presentation were lower than their respective values on day 28th in both the groups and other parameters were gradually increased to reach normal base values by 28th day in both groups. The decreased values of these parameters due to inflammatory reaction caused by severe localized infection and reduced availability of iron in the monocyte/ macrophage system (Rodak, 1995) [15]. A significant decrease in total erythrocyte count, haemoglobin content and packed cell volume in dairy cattle with idiopathic septic arthritis was also reported by Van Pelt (1972) [16]. Similar decrease in these values was also reported by Van Pelt and Langham (1966) [17], Ryan *et al.* (1983) [18] and Ramanathan (2007) [19]. The gradual increase in haemogram values recorded in the present study suggests that the treatment methods were effective in eliminating infection.

The mean total leukocyte count was significantly higher on the day of presentation when compared to their respective values on day 14 in both the groups. At subsequent intervals a gradual decline to reach near normal reference value on day 21 in group I and on day 14 in group II. On the day of presentation a significant increase in the total leucocyte count and neutrophils were noticed in both groups. In septic

arthritis, Leucocytosis with shift to left was reported in cattle by Van Pelt and Langham (1968) [20], Van Pelt (1972) [16] and Pratap *et al.* (1977) [21], Weiser (2004) [22] and Ramanathan (2007) [19]. Moderate to marked leukocytosis characterized predominantly as neutrophilia and hyperfibrinogenemia foals with septic arthritis (Morton, 2005) [23]. Thrombocytosis and neutrophilia with regenerative left shift suggestive of infection and/or inflammation in calves with joint ill (Abdullah *et al.*, 2015) [24]. The granulocytic leucocytosis in calves with septic arthritis reported by Kumar *et al.* (2018) [25]. The total leucocyte count returned to their base values by

21th day in group I and 14th day in group II, which indicates both the treatments were effective control the infection.

5. Conclusion

Intra-articular chitosan drug delivery system impregnated with ceftiofur sodium and honeys were effective for treatment of septic arthritis in calves. However, in group II repeated intra-articular injections were required whereas in group I single intra-articular administration was sufficient with prolonged release of drug in septic joints.

Table 1: Mean \pm SE values of Hb, PCV and TEC recorded at different time intervals in group I and group II animals suffering from septic arthritis.

S. No	Parameter	Days	0	7	14	21	28
1	Haemoglobin (g/dL)	Group I	9.13 \pm 0.12 ^a	9.65 \pm 0.11 ^{ab}	9.66 \pm 0.17 ^b	9.83 \pm 0.13 ^b	9.8 \pm 0.143 ^b
		Group II	9.23 \pm 0.13 ^a	9.35 \pm 0.14 ^a	9.36 \pm 0.11 ^a	9.73 \pm 0.12 ^a	9.75 \pm 0.17 ^a
2	Packed cell volume (%)	Group I	25.33 \pm 1.14 ^a	27.17 \pm 0.30 ^{ab}	27.33 \pm 0.49 ^{ab}	28.33 \pm 0.49 ^{bc}	30.50 \pm 0.56 ^c
		Group II	25.83 \pm 0.47 ^a	27.83 \pm 0.47 ^{ab}	28.83 \pm 1.13 ^{abc}	29.83 \pm 0.65 ^{bc}	31.33 \pm 0.71 ^c
3	Total erythrocyte count ($\times 10^6/\mu\text{L}$),	Group I	4.13 \pm 0.09 ^a	4.15 \pm 0.05 ^a	4.21 \pm 0.07 ^a	4.35 \pm 0.09 ^a	4.70 \pm 0.08 ^b
		Group II	4.08 \pm 0.06 ^a	4.18 \pm 0.07 ^a	4.25 \pm 0.09 ^{ab}	4.48 \pm 0.14 ^{ab}	4.65 \pm 0.14 ^b

Means bearing different superscripts differ significantly ($p < 0.05$)

Table 2: Mean \pm SE values of TLC and DLC recorded at different time intervals in group I and group II animals suffering from septic arthritis.

S. No.	Parameter	Days	0	7	14	21	28	
1	TLC (Thousands/ μL)	Group I	11.11 \pm 0.19 ^a	9.18 \pm 0.15 ^b	8.76 \pm 0.14 ^b	8.65 \pm 0.17 ^{bc}	8.08 \pm 0.06 ^c	
		Group II	10.81 \pm 0.18 ^a	9.11 \pm 0.16 ^b	8.33 \pm 0.16 ^c	8.14 \pm 0.13 ^c	7.95 \pm 0.15 ^c	
2	Differential leucocyte count	Neutrophils (%)	Group I	68.17 \pm 0.65 ^a	54.50 \pm 0.76 ^b	44.33 \pm 0.91 ^c	37.83 \pm 0.79 ^d	32.50 \pm 0.61 ^e
			Group II	66.00 \pm 0.57 ^a	53.67 \pm 0.80 ^b	44.83 \pm 0.65 ^c	36.00 \pm 0.36 ^d	33.67 \pm 0.49 ^d
		Lymphocyte (%)	Group I	24.17 \pm 0.79 ^a	38.67 \pm 1.17 ^b	50.33 \pm 1.08 ^c	56.83 \pm 0.60 ^d	61.83 \pm 0.60 ^e
			Group II	25.67 \pm 0.42 ^a	40.00 \pm 0.73 ^b	50.17 \pm 0.54 ^c	58.50 \pm 0.42 ^d	60.67 \pm 0.61 ^e
		Monocyte (%)	Group I	5.33 \pm 0.33 ^a	4.67 \pm 0.21 ^a	3.17 \pm 0.16 ^b	3.17 \pm 0.30 ^b	3.33 \pm 0.21 ^c
			Group II	5.17 \pm 0.30 ^a	4.00 \pm 0.36 ^{ab}	2.83 \pm 0.30 ^{bc}	2.67 \pm 0.33 ^{bc}	3.50 \pm 0.34 ^c
		Eosinophils (%)	Group I	2.33 \pm 0.21 ^a	2.17 \pm 0.40 ^a	2.17 \pm 0.16 ^a	2.17 \pm 0.30 ^a	2.33 \pm 0.21 ^a
			Group II	3.17 \pm 0.16 ^a	2.33 \pm 0.33 ^a	2.17 \pm 0.47 ^a	2.83 \pm 0.30 ^a	2.17 \pm 0.16 ^a

Means bearing different superscripts differ significantly ($p < 0.05$)

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