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Changes in clinical values of cattle infected with *Clostridium chauvoei* CH₃ strain and a local Kad₁ strain. Haematological values

EL SAWI MOHAMED (O.), TAG EL DIN (M. H.), EL SANOUSI (S. M.). Changements cliniques chez les bovins infectés par la souche CH₃ et la souche locale Kad₁ de *Clostridium chauvoei*. Valeurs hématologiques. *Revue Élev. Méd. vét. Pays trop.*, 1989, 42 (2) : 169-172.

Le charbon symptomatique occasionné par les souches CH₃ et Kad₁ de *Clostridium chauvoei* a provoqué des changements marqués dans les paramètres sanguins ; ces modifications ont été plus importantes avec la souche CH₃ qu'avec la souche locale Kad₁. Les résultats ont révélé, dans les valeurs hématologiques des veaux infectés par l'agent causal, une augmentation des globules rouges, de l'hématocrite, de l'hémoglobine et du nombre de leucocytes. La concentration et la teneur corpusculaires moyennes en hémoglobine sont restées dans les limites des valeurs normales alors qu'une hausse significative du volume corpusculaire moyen est apparue en phase terminale. Après l'infection, les thrombocytes ont fortement chuté jusqu'à la mort des animaux. *Mots clés* : Bovin - Veau - Charbon symptomatique - *Clostridium chauvoei* - Hématologie - Soudan.

INTRODUCTION

Blackleg occurs most frequently in cattle followed by sheep and goats. STERNE (4) reported that blackleg in pigs is almost invariably caused by *C. septicum*.

In the Sudan the disease is controlled by annual vaccination using a whole bacterial formalinized culture.

Little work had been done on clinical changes that might be exerted in cattle infected with *C. chauvoei*. BARNES (1) reported a few clinical values in conjunction with his work on the pathologic effects of *C. chauvoei* infection. Additional clinical values which accompanied *C. chauvoei* infection were reported by PEMBERTON *et al.* (2).

We hereby report changes in haematological values that follow blackleg disease.

MATERIALS AND METHODS

Inoculum

An overnight growth of *C. chauvoei* CH₃ and Kad₁

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strains in reinforced clostridial medium (RCM) was diluted to contain approximately 4.6×10^7 C.F.U./ml and 3.4×10^8 C.F.U./ml respectively. Calcium chloride (Analar) prepared in a sterile solution (5 per cent), was used in the challenge test favouring germination and growth of the spores.

Animals

Fifteen Kenana calves 1-2 years old were used in this study. They were divided equally into three groups A, B and C. These calves were inoculated deep intramuscularly in the left gluteal muscles. Each calf in group A received 3 mls *C. chauvoei* CH₃ suspended in 1 ml calcium chloride. Each calf in group B was inoculated with 3 mls *C. chauvoei* Kad₁ strain in 1 ml calcium chloride. Calves in group C remained as controls and each one received a dose of 3 mls normal saline.

Haematology

Blood was collected from the jugular veins of calves in groups A, B and C in vacutainer tubes containing EDTA as anticoagulant. Collection was performed 10 days pre-challenge at 3 day-intervals, immediately before challenge and thereafter for 66 hours post-challenge at 6 hour-intervals.

Erythrocytic series

Packed cell volume (PCV)

The freshly collected blood samples were centrifuged using a microhaematocrit centrifuge for five minutes. The percentage of the PCV was read from the scaling instrument attached with the centrifuge and the readings obtained were converted to litre per litre (l per l).

Haemoglobin concentration (Hb)

By using haemoglobinmeter, the concentration of Hb was determined by the method of cyanmethaemoglobin (3). The concentration of Hb was obtained in grammes per 100 ml of blood and was then converted to grammes per decilitre (g/dl).

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Red blood cell count (RBC)

Red blood cells were counted using improved Neubauer haemocytometers. Formal citrate was used as a diluent.

Mean corpuscular volume (MCV)

Mean corpuscular volume in cubic microns (μ^3), was obtained from values of PCV and RBC using the following formula :

$$\text{MCV } (\mu^3) = (\text{PCV per cent} \times 10) / (\text{RBC in millions/cmm})$$

Values of mean corpuscular volume were then obtained in femtolitres (fl).

Mean corpuscular haemoglobin concentration (MCHC per cent)

The MCHC was calculated from PCV and Hb values :

$$\text{MCHC (per cent)} = (\text{Hb in g per 100 ml} \times 100) / (\text{PCV per cent})$$

The resultant values were then calculated in g/dl.

Mean corpuscular haemoglobin (MCH)

This expresses the average Hb content in picograms (pg) of a single RBC.

$$\text{MCH} = (\text{Hb} \times 10) / (\text{RBC}) \text{ pg.}$$

Leukocytic series

White blood cell count (WBC)

Improved Neubauer haemocytometers were also used to determine the total count of white blood cells. The diluent used was Turk's fluid (one per cent glacial acetic acid, tinged with gentian violet).

Differential count of white blood cells

Differential leukocyte count was obtained using the battlement method (3). Blood films were prepared from the freshly collected blood using Leishman's stain. A minimum of 100 cells in each blood smear was counted and the results were obtained average percentage.

RESULTS

Results of changes in the haematological values in calves infected with *C. chauvoei* CH₃ and Kad₁ strains are graphically represented. Although the results obtained by these strains were similar, strain CH₃ displayed more changes in these values than Kad₁ strain.

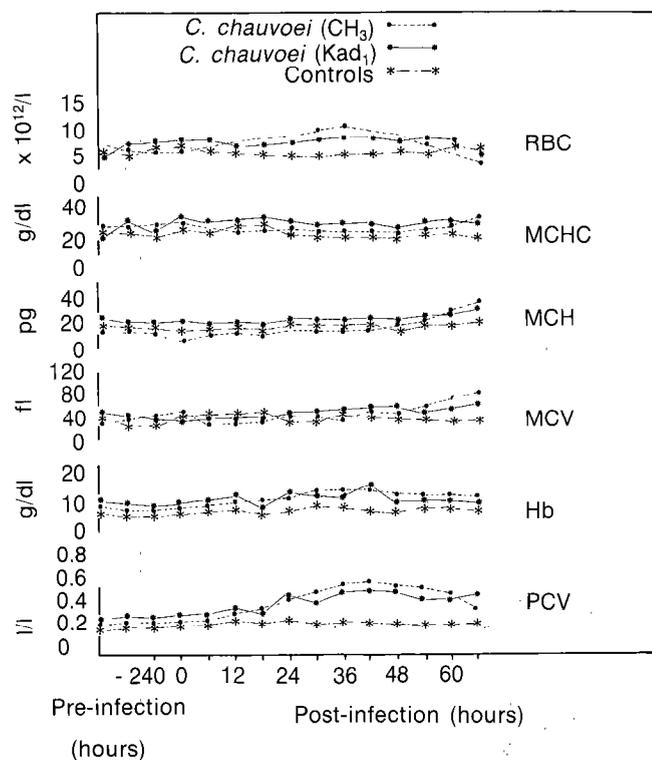


Fig. 1: Values of Red blood cells, Mean corpuscular haemoglobin concentration, Mean corpuscular haemoglobin, Mean corpuscular volume, Haemoglobin and Packed cell volume.

Values of RBC, MCHC, MCH, MCV, Hb and PCV are presented graphically in figure 1. A significant increase ($P < 0.05$) in RBC count was obtained between hours 30 and 42 post-infection when compared with the control. This increase reached its maximum value at hour 36 post-infection ($10.8 \times 10^{12}/l$). A significant decrease ($P < 0.05$) in RBC count was detected terminally. Packed cell volume steadily increased immediately post-infection with a highly significant maximal value ($P < 0.01$). This increase was almost throughout the period of the experiment. On the other hand, Hb concentration also showed a significant increase ($P < 0.05$) which continued to the time of death of the animals. Values of MCHC and

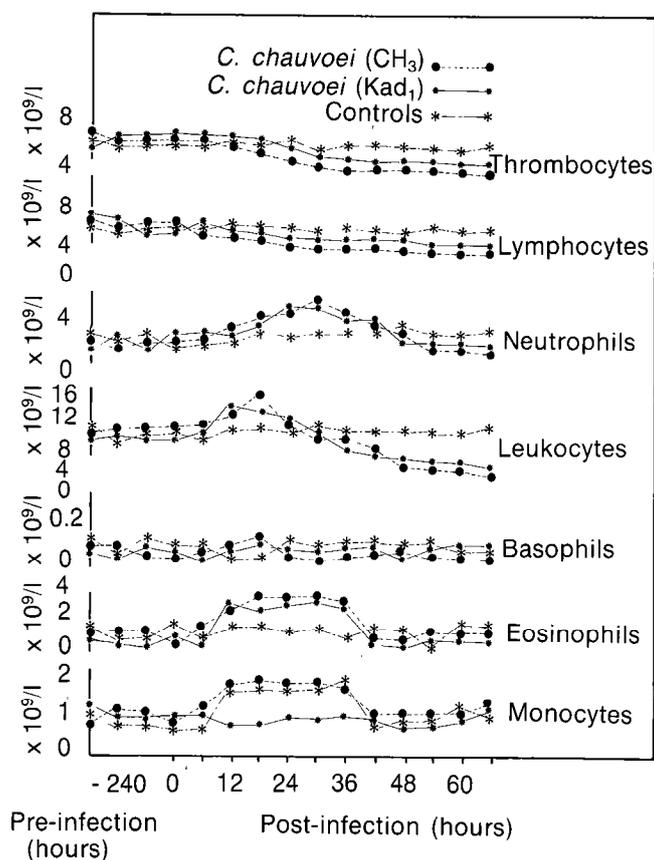


Fig. 2 : Thrombocytes and the total and differential leukocyte count.

MCH remained within normal range values, however, a terminal significant increase ($P < 0.05$) of MCV was obtained.

Thrombocytes and the total and differential white blood cell counts are shown in figure 2. A significant increase ($P < 0.05$) in the total leukocyte count occurred between hours 6-24 post-infection with a maximum of ($15.4 \times 10^9/l$) obtained at hour 18. Thereafter, a highly significant decrease with a minimal value of ($5.9 \times 10^9/l$) was obtained terminally. A significant decrease in lymphocyte count ($P < 0.05$) started immediately post-infection and continued throughout the experiment with a minimum count of ($1.3 \times 10^9/l$) obtained terminally. A significant neutrophilia ($P < 0.05$) occurred between hours 12-48 post-infec-

tion, reached the maximum of ($6.8 \times 10^9/l$) at hour 30. Thereafter, the count started to decrease significantly towards death of the animals. Thrombocytes showed a steady drop after infection with a minimal significant value of ($1.6 \times 10^9/l$) at hour 30 post-infection. This decrease continued to the time of death of the animals.

DISCUSSION

The main haematological changes in cattle which died of blackleg disease were marked thrombocytopenia, lymphopenia, leukopenia and neutropenia. However, the increase in total leukocytes count observed during the first hours post-infection of calves with *C. chauvoei* CH₃ and Kad₁ strains was mainly due to neutrophilia and moderate eosinophilia.

The increase in erythrocyte number, Hb concentration, PCV and total plasma proteins might have been due to a decrease in plasma volume resulting from dehydration. Our results indicate that oedema is a salient feature of blackleg disease in calves. This might have been due to hypoproteinaemia brought about by liver damage in the terminal stage of the disease. The decrease in RBC count towards death is attributed to haemorrhages and/or haemolysis due to toxæmia caused by the organisms. Lymphocytes escape from the blood to the site of infection resulting in lowered lymphocyte count. The increase in MCV may be due to the engorgement of the cells.

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Clostridium chauvoei CH₃ and Kad₁ strains were found to cause marked changes in the blood parameters during the course of blackleg disease. These changes displayed by CH₃ were found to be more marked than the local Kad₁ strain. Results of changes in the haematological values in calves infected with blackleg organisms, showed an increase in RBC, PCV, Hb and the total leukocyte count. MCHC and MCH remained within normal range values, however, a terminal significant increase of MCV was obtained. Thrombocytes showed a steady drop after infection to the time of death of the animals. *Key words* : Cattle - Calf - Blackleg disease - *Clostridium chauvoei* - Haematology - Sudan.

El carbunco sintomático causado por las cepas CH₃ y Kad₁ de *Clostridium chauvoei* provocó modificaciones acentuadas de los parámetros de la sangre. Las dichas fueron más importantes con la cepa CH₃ que con la cepa local Kad₁. Los resultados observados en terneros infectados mostraron un aumento de los eritrocitos, del hematocrito, de la hemoglobina y del número de los leucocitos. La concentración y la tasa corpusculares medias de hemoglobina quedaron en los límites de los valores normales mientras que un crecimiento significativo del volumen corpuscular medio apareció durante la fase terminal. Después de la infección, los trombocitos bajaron mucho hasta la muerte de los animales. *Palabras claves* : Bovino - Ternero - Carbunco sintomático - *Clostridium chauvoei* - Hematología - Sudán.

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