# EFFECTS OF CEFTRIAXONE ON HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERS OF TURKEY

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**ABSTRACT**

***Short-term effects of ceftriaxone on haematological and biochemical parameters of Nigerian local turkey poults were studied. The pre-treatment blood and serum samples were collected and the weight of animals taken before the administration of body weight for a period of 4 days. The animals were weighed daily. The results showed that eosinophilia was significantly increased (P < 0.05) and total bilirubin deceased significantly (P < 0.05). Furthermore, there was significant decrease in chloride ion (P < 0.05) and increase in bicarbonate ion (P < 0.05). Other indices of haematology, liver function test and electrolyte titration were normal (P < 0.05). Ceftriaxone caused eosinophilia in treated samples (2.2 ± 0.45$^a$) as compared to pre-treated samples (1.6 ± 0.89$^b$). Total bilirubin in the post-administration samples (13.5 ± 1.05$^a$) was decreased in comparison with pre-administration samples (14.82 ± 0.72$^b$). Chloride ion decreased in the treated samples (86.6 ± 8.11$^a$) when compared with untreated samples (98.4 ± 2.88$^b$). Bicarbonate ion increased (24.8 ± 1.79$^a$) in the experimental samples when compared to control (24.4 ± 1.34$^b$). Conclusively, the short term administration of ceftriaxone may cause eosinophilia, hypobilirubinaemia, hypochloraemia and increased bicarbonate ion which may be positive response to hypochloraemia.***

**Keywords:** Haematology, Biochemical Parameters, Ceftriaxone, Turkey

## INTRODUCTION

The cephalosporins (β-lactam antibiotics) are weak organic acids, due to their low pka values, and are predominantly ionized in the blood plasma (Baggot, 2001). Protein binding of individual cephalosporins ranges from 15 % to over 80 %. The presence of food in the stomach decreases the systemic availability of oral cephalosporins (Baggot, 2001).

Ceftriaxone is a parenteral third generation cephalosporin, which has stronger activity against enterobacteriaceae, including penicillinase producing strains (Hubber, 1988). Ceftriaxone has longer duration of action because of extensive protein binding permitting once or at most twice daily dosing (Prescott, 2000) and is eliminated equally in urine and bile (Tripathi, 2003). It penetrates poorly into transcellular fluid e.g. cerebrospinal fluid (CSF), synovial fluid and aqueous humor but has half-life of 0.8 h in dog (Baggot, 2001). The overall effectiveness of therapy with cephalosporins is largely influenced by the aggregate time, though not necessarily continuous during which effective plasma concentrations are maintained (Baggot, 2001). The protein binding of individual drugs with the same class of chemical e.g. cephalosporins can differ widely in disease conditions like hepatic cirrhosis, liver abscess, acute pancreatitis, gastrointestinal disease, nephrotic syndrome and chronic renal failure (Baggot, 2001). Gastrointestinal disturbances including severe colitis were noted with ceftriaxone administration in mare (Gardner and Aucoin, 1994), probably because of its billiary excretion (Prescott, 2000). Saganuwan (2006) also reported hypoproteinaemia, and hyperkalaemia in Nigerian mongrel dog. Intravenous or intramuscular, 25 mg/kg body weight of ceftriaxone, 12-24 hourly is sufficient in dog (Prescott, 2000).

Since species variation, environmental and nutritional factors sometimes play great role in kinetic of drugs, this study was aimed at investigating the haematological and biochemical parameters of Nigerian local turkey poults given 50 mg/kg body weight of ceftriaxone. The safety of the singe dose of 50 mg/kg body weight was investigated.

## MATERIALS AND METHODS

**Experimental Animals:** Five turkey poults of either sex each weighing 1 kg were used for the study. The turkeys were purchased from one Mr. S. Ogalue's farm at Federal Staff Quarters, Makurdi, Benue State, Nigeria. They were 5 months old and fed grower's marsh daily, water was provided *adlibitum.* The turkeys were housed in a fairly large metal cage during the experiment.

**Drug Administration and Sample Collection:** Ceftriaxone was administered daily into the wing vein of the 5 turkeys at the dose rate of 50 mg/kg for a period of 4 days. Prior to administration of ceftriaxone, control blood samples were collected from the turkeys; 1 ml of blood was collected from the wing vein of each turkey into test tubes

containing ethylenediamminetetraacetate (EDTA) as anticoagulant for determination of haematological parameters. Another 2 mls of whole blood was collected from each turkey but allowed to coagulate and serum collected for quantitative in vitro determination of biochemical parameters; liver function test and electrolytes determination.

At the end of 4-day trial, another 1 ml of blood sample was collected from the wing vein of each turkey into EDTA bottle and 2 mls of whole blood was collected from each turkey and allowed to coagulate in order to obtain serum for determination of haematological and biochemical parameters respectively.

**Determination of Haematological and Biochemical Parameters:** Total blood cells count was done using the method of Baker (1985). Total protein was determined using biuret method (Tietz, 1995). Albumin was determined using bromocresol green method (Doumas, 1971). Conjugated bilirubin and total bilirubin were determined using the method of Jendrassik and Grof (1938). Whereas serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) were determined using the method of Reitman and Frankel (1957). Sodium ion ($Na^+$) and potassium ion ($k^+$) were determined using flame photometric method (Fawcett and Scott, 1960). Both bicarbonate ion ($HCO^-_3$) and chloride ion ($Cl^-$) were determined using titration method (Chaney and Marbach, 1962). All the parameters were determined before administration and 4 days after drug administration.

**Statistical Analysis:** The data on haematological and biochemical parameters were expressed as mean $\pm$ S.D. Tests for significance between mean parameters in respect of pre-administration and post-administration values were performed using students'-test (Petrie and Watson, 2002).

## RESULTS

Haematology revealed significant increased level of eosinophils ($P < 0.05$). But white blood cells (WBC), packed cell volume (PCV), neutrophils, lymphocytes, monocytes and basophils were not significantly affected ($P > 0.05$) (Table 1). However, the animals were pale with patches of light blue colouration beneath their skins. The patches disappeared a week after the experiment.

Liver function test revealed decreased level of total bilirubin ($P < 0.05$). But total protein, Albumin, conjugated bilirubin, Alkaline phosphatase, serum glutamic oxaloacetic transaminase (SGOT) and serum pyruvic transaminase (SGPT) were not affected significantly ($P < 0.05$) by the intravenous administration of ceftriaxone (Table 2).

Electrolyte concentration has shown that sodium ion ($Na^+$), potassium ion ($k^+$) and calcium ion ($Ca^{++}$) were not affected significantly ($P > 0.05$) as chloride ion ($Cl^-$) decreased significantly ($P < 0.05$). However, bicarbonate ion ($HCO^-_3$) increased significantly ($P < 0.05$) as a result of intravenous administration of ceftriaxone (Table 3).

## DISCUSSION

The significant increase in eosinophils in the post-administration samples ($2.2 \pm 0.45^a$) as compared to the pre-administration samples ($1.4 \pm 0.55^b$) may be attributable to either antigen-antibody reaction or parasitism. This is supported by the report of Aka (2004) that eosinophils appear much in the following areas in the body e.g. the sites of antigen-antibody reaction, inflammation, blood clotting and in condition of heavy parasitism. Eosinophils kill parasites, and regulate the intensity of hypersensitivity reactions mediated by immunoglobulin (lgE). For a strong eosinophilic response to occur, the parasite must be in the animal's tissue (Willard et al., 1989).

**Table 1: Effects of intravenous ceftriaxone on haematological parameters of turkey**

| Indices | Control (Pre administration) | Experimental (Post administration) |
|---|---|---|
| **Packed cell volume %** | $33.2 \pm 3.56^a$ | $31.8 \pm 2.28^b$ |
| **White blood cells x 10 %** | $4.68 \pm 1.45^a$ | $5.08 \pm 0.91^b$ |
| **Neutrophils %** | $53.4 \pm 16.06^a$ | $50 \pm 7.90^b$ |
| **Lymphocytes %** | $44.6 \pm 15.52^a$ | $45.4 \pm 8.23^b$ |
| **Monocytes %** | $1.4 \pm 0.55^a$ | $2.4 \pm 0.55^b$ |
| **Eosinophils %** | $1.6 \pm 0.89^b$ | $2.2 \pm 0.45^a$ |
| **Basophils %** | $0 \pm 0.0^a$ | $0 \pm 0.0^b$ |

*Key: Similar letters on the same row = statistically not significant*

**Table 2: Effects of intravenous ceftriaxone on liver function parameters of turkey**

| Indices | Control (Pre administration) | Experimental (Post administration) |
|---|---|---|
| **Total protein (g/l)** | $35.18 \pm 1.45^a$ | $43.1 \pm 15.33^b$ |
| **Albumin (g/l)** | $33.02 \pm 2.09^a$ | $33.12 \pm 1.90^b$ |
| **Total bilirubin (μmol/l)** | $14.82 \pm 0.72^b$ | $13.5 \pm 1.05^a$ |
| **Conjugated bilirubin (μmol/l)** | $2.92 \pm 0.63^a$ | $2.86 \pm 0.67^b$ |
| **Alkaline phosphatase (μg/l)** | $119.6 \pm 7.13^a$ | $110.4 \pm 6.10^b$ |
| **Serum Glutamic Oxaloacetic transaminase (μg/l)** | $114.3 \pm 18.79^a$ | $114.3 \pm 18.79^b$ |
| **Serum Glutamic Pyruvic transaminase (μg/l)** | $4.0 \pm 0.0^a$ | $5.2 \pm 1.64^b$ |

**Table 3: Effects of intravenous ceftriaxone on electrolyte concentration in turkey**

| Indices | Control (Pre administration) | Experimental (Post administration) |
|---|---|---|
| **Sodium ion (mmol/l)** | 134 ± 2.45[a] | 133.4 ± 2.19[b] |
| **Potassium ion (mmol/l)** | 3.8 ± 0.37[a] | 3.68 ± 0.46[b] |
| **Chloride ion (mmol/l)** | 98.4 ± 2.88[b] | 86.6 ± 8.11[a] |
| **Bicarbonate ion (mmol/l)** | 24.4 ± 1.34[b] | 24.8 ± 1.79[a] |
| **Calcium ion (mmol/l)** | 3.26 ± 0.43[a] | 3.26 ± 0.63[b] |

*Key: Similar letters on a row = statistically not significant*

Nevertheless, the decrease in total bilirubin of experimental samples (13.5 ± 1.05[a]) in comparison with the control (14.82 ± 0.72[b]) may be due to displacement of plasma bilirubin by ceftriaxone. This finding agrees with the earlier reports of Willard et al (1989) that decrease bilirubin may be due to drugs that displace bilirubin from albumin, and Baggot (2001) reported that the binding of individual cephalosporins range from 15 to over 80 % as hyperbilirubinaemia could further decrease the albumin binding capacity of acidic drugs. Although patches of blue colouration were seen beneath the skins of the experimental turkeys, the blue colouration may be green bilverdin ix since turkeys do not produce bilirubin (Aka, 2004). This may be responsible for decreased total bilirubin observed in the experimental post-administration samples. So since ceftriaxone binds extensively to plasma proteins, invariably it may decrease renal excretion or hinder or facilitate drug elimination.

The decrease in the chloride ion ($Cl^-$) and increased bicarbonate ion ($HCO^-_3$) in the post-administration samples are a clear indication of the ability of ceftriaxone to cause metabolic alkalosis in turkey poults. Since ceftriaxone causes hypochloraemia, that may be characteristic of extensive binding acidic drugs. However, the increased bicarbonate ion observed could be a positive response to plasma hypochloraemia. This mechanism is important in maintenance of red blood cells integrity.

**Conclusion:** Ceftriaxone (50 mg/kg) body weight caused eosinophilia, decreased total bilirubin, hypochloraemia and increased bicarbonate ion. Hence, ceftriaxone should be administered to turkey with caution.

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