



Pharmacokinetics of ceftiofur in local goat of Assam following single intramuscular administration

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Abstract

The study was undertaken to determine the pharmacokinetics of ceftiofur after single intramuscular (i/m) injection in local goat of Assam. An injectable commercial preparation of ceftiofur was injected at the dose rate of 2.2 mg/kg⁻¹ body weight by i/m route in each of six male local goats (*Capra hircus*) of Assam. Bioavailability (F) of 81.90 ± 3.427% was achieved after the administration of the drug. AUC was found to be 345.647 ± 15.395 µg/ml⁻¹.min. Mean absorption half-life (t_{1/2Ka}) of 9.803 ± 0.599 min was achieved indicating good absorption rate of the drug.

Keywords: Assam, bioavailability, ceftiofur, goat, pharmacokinetics

Introduction

Cephalosporins are the class of beta lactam antibiotics which are derived from the fungus *Cephalosporium* sp. Cephalosporins are classified into five generations. Ceftiofur is a third-generation broad spectrum cephalosporin that has been developed specially for veterinary use. Among all cephalosporins, ceftiofur appears to be a promising drug for use in ruminant species. It has good spectrum of activity against both gram positive and gram-negative bacteria. (Zwald *et al.*, 2004) [9]. It was first developed for the treatment of bovine respiratory disease including small ruminants.

Goat (*Capra hircus*) is an important animal that is reared extensively for meat purpose in Assam. But pharmacokinetic studies of ceftiofur in local goat of Assam have not been reported till date. Thus, the present study was undertaken to determine the kinetics of ceftiofur after single intramuscular (i/m) injection in local goat of Assam.

Materials and Methods

Xceft (Alembic), an injectable commercial preparation of ceftiofur was injected at the dose rate of 2.2 mg/kg⁻¹ body weight by i/m route in each of six male local goats (*Capra hircus*) of Assam. All goats were de-wormed and were clinically sound and healthy. All the ethical principles were followed during the course of the experiment.

Blood samples (3 ml) were collected by jugular vein puncture with the help of a 5 ml syringe, into heparinised vacutainer tubes from each animal prior and after the drug administration. The time of blood collection following i/m route were 5, 10, 15, 30, 45, 60, 120, 240, 360, 480, 600, 720 and 1440 min respectively. Plasma was extracted after centrifugation of blood samples at 3500 rpm for 15 min at

room temperature. The concentration of ceftiofur in plasma was estimated by Spectrophotometric method (Annapurna *et al.*, 2009) [1] with slight modification. Standard curve of ceftiofur having correlation coefficient of 0.9999 was obtained.

Results and Discussions

Following single i/m administration of ceftiofur at the dose rate of 2.2 mg/kg⁻¹ of body weight, the mean peak plasma level of ceftiofur was 10.153 ± 0.185 µg.ml⁻¹ at 15 min, which declined rapidly to 3.1670 ± 0.078 µg.ml⁻¹ at 120 min, thereafter the decline was steady and the lowest concentration of 0.075 ± 0.003 µg.ml⁻¹ was observed at 720 min (Table 1). T_{max} of 15.00 ± 0.00 min was achieved rapidly in the plasma of goats in comparison to Elephant, Cattle and Deer (Halstead *et al.*, 1992 ; Drew *et al.*, 2004 and Dumonceaux *et al.*, 2005) [8, 4, 5]. As shown in Table 2, Bioavailability (F) was found to be 81.90 ± 3.427%. This value was nearly consistent with that reported in Buffalo (El Gendy *et al.* 2007). This was less than that found in sheep and camel (Craigmill *et al.*, 1997 and Goudah, 2007) [3, 7]. This average Bioavailability of ceftiofur in goats indicates that the drug was available less adequately to systemic circulation after intramuscular administration. This may be due to ion trapping effect as the drug is acidic in nature or due to its quicker biotransformation. The value of mean absorption half-life (t_{1/2Ka}) was found to be 9.803 ± 0.599 min which indicates good absorption rate of the drug after i/m administration. The value of t_{1/2β} was 79.937 ± 4.902 min which was less than in lactating goat (Courtin *et al.*, 2007) [2]. The values of AUC obtained after i/m administration of 2.2 mg/kg⁻¹ body weight was 345.647 ± 15.395 µg.ml⁻¹.min, which was less than reported in deer (Drew *et al.*, 2004) [4].

Table 1: Plasma concentrations ($\mu\text{g/ml}$) of Ceftiofur in goat after i.m. administration at the dose rate of 2.2mg/kg body weight (n=6).

Time(min)	Animals						Mean \pm SE
	G1	G2	G3	G4	G5	G6	
5	0.43	0.31	0.36	0.44	0.48	0.29	0.385 \pm 0.0312
10	3.20	2.41	2.87	3.26	3.60	2.57	2.985 \pm 0.1840
15	10.45	9.63	9.87	10.79	10.38	9.80	10.153 \pm 0.1847
30	8.85	7.54	7.81	8.91	8.76	7.70	8.261 \pm 0.2617
45	7.11	6.53	6.85	7.27	7.08	6.65	6.915 \pm 0.1174
60	5.26	5.03	5.11	5.54	5.17	5.09	5.200 \pm 0.0750
120	3.30	2.89	3.16	3.41	3.23	3.01	3.167 \pm 0.0779
240	2.20	1.41	1.88	2.31	2.10	1.73	1.938 \pm 0.1364
360	1.82	1.07	1.26	2.09	1.60	1.43	1.545 \pm 0.1522
480	1.31	0.78	0.6	1.66	1.23	1.11	1.115 \pm 0.1555
600	0.72	0.48	0.35	1.18	0.72	0.78	0.705 \pm 0.117
720	0.07	0.08	0.08	0.08	0.06	0.08	0.075 \pm 0.0034
1440	ND	ND	ND	ND	ND	ND	ND

Table 2: Pharmacokinetics of Ceftiofur after single i.m. administration at the dose rate of 2.2 mg/kg in goat (n=6).

Parameter	Animals							Mean \pm SE
	units	1	2	3	4	5	6	
A \bar{c}	$\mu\text{g/ml}$	10	9	9.9	11	9.1	10	9.833 \pm 0.297
B	$\mu\text{g/ml}$	4.8	4.3	3.9	4.7	4.9	3.5	4.350 \pm 0.228
Ka	min ⁻¹	0.0856	0.0727	0.0586	0.0735	0.0801	0.0614	0.072 \pm 0.004
T _{1/2Ka}	min	8.095	9.532	11.8259	9.4285	8.6516	11.286	9.803 \pm 0.599
β	min ⁻¹	0.009	0.009	0.008	0.009	0.011	0.007	0.009 \pm 0.001
T _{1/2β}	min	77.00	77.00	86.62	77.00	63.00	99.00	79.937 \pm 4.902
V _{d(B)}	L/kg	0.458	0.511	0.564	0.468	0.448	0.628	0.513 \pm 0.029
F	%	89.60	83.19	70.73	78.75	93.02	76.15	81.907 \pm 3.427
AUC	$\mu\text{g}\cdot\text{min/ml}$	393.816	353.98	284.546	372.56	331.85	337.13	345.647 \pm 15.395
C _{max}	$\mu\text{g/ml}$	10.45	9.63	9.87	10.79	10.38	9.80	10.153 \pm 0.185
T _{max}	min	15.0	15.0	15.0	15.0	15.0	15.0	15.00 \pm 0.00

Conclusion

The kinetic parameters of ceftiofur in six male local goat of Assam following single intramuscular administration at 2.2 mg.kg⁻¹ bodyweight were studied. Bio availability (F) of 81.90 \pm 3.427% was achieved. Mean absorption half-life (t_{1/2Ka}) of 9.803 \pm 0.599 min was achieved indicating good absorption rate of the drug. AUC was found to be 345.647 \pm 15.395 $\mu\text{gml}^{-1}\cdot\text{min}$.

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