Study of serum levels of cefquinome in goats by using microbiological assay method

MK Patil, AP Somkuwar and NZ Gaikwad

DOI: https://doi.org/10.22271/chemi.2021.v9.i1a.11334

Abstract
For this study, 12 goats of either sex were selected. A group of six goats was administered with cefquinome @ 2 mg/kg by intramuscular route and another group of six goats was administered with cefquinome @ 2 mg/kg by intravenous route. The serum cefquinome concentrations in adult goats were determined up to 24 hrs after drug administration by using microbiological assay method. In the present study the therapeutic concentrations of cefquinome were maintained for more than 8 hours (0.08 ± 0.011mcg/ml) after intravenous administration and intramuscular administration and at the time of 10th hr sampling the cefquinome was not detected in serum after either intramuscular or intravenous administration.

Keywords: Serum levels, cefquinome, goats, microbiological assay

Introduction
Cefquinome, an aminothiazolyl cephalosporin is a member of the 4th generation of cephalosporin’s which have been developed solely for veterinary use [5, 6]. To decide the drug dose administration interval it is necessary to study the serum levels of cefquinome at different intervals of drug administration. Therefore the present study was planned to study the serum levels of cefquinome in goats by using microbiological assay method after intramuscular and intravenous administration of cefquinome.

Materials and Method
For this study, 12 goats of either sex were selected. A group of six goats was administered with cefquinome @ 2 mg/kg by intramuscular route and another group of six goats was administered with cefquinome @ 2 mg/kg by intravenous route. The serum cefquinome concentrations in adult goats were determined up to 24 hrs after drug administration by using microbiological assay technique using large glass plate [1, 2, 3]. The serum cefquinome levels data were analyzed by randomized block design and the significance was tested at 5% and 1% levels as per [7]. It is to state that the approval of Institutional Animal Ethics committee was approved for this research work.

Results and Discussion
The serum cefquinome concentrations in adult goats were determined up to 24 hrs after drug administration by using microbiological assay method. The assay sensitivity was found to be 0.05mcg/ml. The mean serum cefquinome concentrations at different time intervals in goats after administration of single dose (2 mg/kg body weight) by intravenous and intramuscular routes are presented in Table no. 1 and 2 respectively.

The zero time serum concentration (C0p) of cefquinome in goats receiving it by intravenous route of administration was found to be 2.41± 0.40 mcg/ml and the serum cefquinome concentrations were detectable up to 8 hours (0.08 ± 0.011mcg/ml) post administration. The maximum serum cefquinome concentration observed was 1.82 ± 0.317 mcg/ml at 0.0416 hrs (2.5 min) of sampling time. The MIC90 of cefquinome for a range of microorganisms has been reported differently by various researchers from 0.024 to 1.563 mcg/ml for maximum number of bacteria.
In the present study the therapeutic concentrations of ceftiquinome were maintained for more than 8 hours (0.08 ± 0.011 mcg/ml) after intravenous administration and at 10 hours the ceftiquinome concentration was not detected.

Table 1: Serum concentration of ceftiquinome at different time intervals after intravenous administration (2 mg/kg B.W.) in goats.

| Time (in hrs) | Concentrations (mcg/ml) in Goat Mean SDTV ± S.E. |
|--------------|-----------------------------------------------|
| G1 G2 G3 G4 G5 G6 | 0 0 0 0 0 0 | 0 0 0 0 0 0 |
| 0.0416 | 1.45 2.45 0.71 2.35 1.30 2.65 | 1.82 0.77 0.317 |
| 0.0833 | 1.00 1.45 0.51 1.05 0.87 2.00 | 1.15 0.56 0.211 |
| 0.167 | 0.84 1.25 0.44 0.90 0.74 1.70 | 0.98 0.44 0.179 |
| 0.25 | 0.68 1.00 0.39 0.74 0.63 1.40 | 0.81 0.31 0.143 |
| 0.5 | 0.51 0.84 0.36 0.58 0.56 1.25 | 0.68 0.31 0.130 |
| 1.0 | 0.37 0.68 0.33 0.50 0.47 0.94 | 0.55 0.22 0.093 |
| 2.0 | 0.26 0.51 0.29 0.39 0.39 0.68 | 0.42 0.15 0.063 |
| 4.0 | 0.16 0.29 0.19 0.24 0.24 0.37 | 0.25 0.07 0.031 |
| 6.0 | 0.11 0.20 0.11 0.20 0.15 0.19 | 0.16 0.04 0.018 |
| 8.0 | 0.07 0.12 0.07 0.05 0.09 0.11 | 0.08 0.02 0.011 |
| 10.0 | ND ND ND ND ND ND | --- --- --- |

ND=not detected

The peak serum concentration (C max) of ceftiquinome as shown in Table no. 2, was 1.77 ± 0.082 mcg/ml and it was observed at half an hour (T max) after administration of ceftiquinome by intramuscular route in goats. The ceftiquinome was detectable in serum up to 8 hours and the average concentration observed was 0.13 ± 0.005 mcg/ml. At the time of 10th hr sampling the ceftiquinome was not detected in serum after either intramuscular or intravenous administration.

In accordance with our results, [9] observed maximum concentration of 2.60 ±0.14 mcg/ml at 0.5 hrs and could detected plasma ceftiquinome levels of about 0.06 mcg/ml at eight hours after intramuscular administration in sheep at the dose rate of 2 mg/kg. [8] reported the maximum concentration of 1.205 ± 0.078 mcg/ml at 2.174±0.056 hrs in sheep could detect ceftiquinome up to 12 hours which is approximately 0.2 mcg/ml. [4] studied ceftiquinome pharmacokinetic in pigs after IM routes, for which they estimated the plasma ceftiquinome concentrations by microbiological assay and HPLC methods. They compared the pharmacokinetic parameters and observed that maximum concentration by microbiological method was 0.30 ±0.16 mcg/ml and by LC/MC was 0.40 ± 0.15 mcg/ml respectively at 1.99 ±0.82 and 2.33 ± 0.63 hours. They observed the ceftiquinome concentrations up to 0.03 by microbiological method and 0.04 by LC/MS.

Conclusion
It was concluded that the serum concentration of ceftiquinome was maintained up to 8 hours of intramuscular and intravenous administration of ceftiquinome in goats @ 2 mg/Kg body weight. At the time of 10th hr sampling the ceftiquinome was not detected in serum after either intramuscular or intravenous administration.

References
1. Bennet JV, Brodie JL, Benner EJ, Kirby MM. Simplified accurate method for antibiotic assay in clinical specimen. Appl. Microbiol 1966;14:170-177.
2. Black WD, Holt JD, Gentry RD. Pharmacokinetic study of neomycin in calves following intravenous and intramuscular administration. Can. J. Comp. Med 1983;47:433-435.
3. Burrows GE, Barto PB, Martin BM. Comparative pharmacokinetics of gentamicin, neomycin and oxytetracycline in newborn calves. J. Vet. Pharmacol. Therap 1987;10:54-63.
4. Limp Wong-Hwan, Hong-Gee Lee, Tae-Won Kim, In-Bae Song, Myoung-seok Kim, Youn-Hwan Hwang, et al. Comparison of Microbiological Assay and High-Performance Liquid Chromatography/Mass Spectrometry for the Pharmacokinetics of ceftiquinome in Pigs. Agricultural Journal 2011;6 (6):374-377.
5. Limbert Michael, Isert Dieter, Klesel Norbert, Markus Astrid, Seeger Karl, Seibert Gerhard, et al. Antibacterial activities in vitro and in vivo and pharmacokinetics of ceftiquinome (HR 111V), a new broad-spectrum Cephalosporin. Antimicrobial agents and Chemotherapy, Jan 1991, Pp.14-19.
6. Murphy SP, Erwin ME, Jones RN. Cefquinome (HR 111V). In vitro evaluation of a broad-spectrum cephalosporin indicated for infections in animals. Diagn. Microbiol. Infect. Dis 1994;20:49-55.
7. Sneedecor GW, Cochran WG. Statistical methods. Pp. 534. Oxford and IBH Publication Co., Calcutta 1968.
8. Tohamy MA. Age-related intramuscular pharmacokinetics of ceftiquinome in sheep. Small Ruminant Research 2011; (99):72-76.
9. Uney Kamil, Feray Altan, Muammer Elmas. Development and validation of a high-performance liquid chromatography Method for Determination of Cefquinome concentrations in sheep plasma and its application to Pharmacokinetic studies. Antimicrobial agents and Chemotherapy 2011, 854-859.

"30"