Erythrocyte uptake of drugs and its impact on volume of distribution (V_D) determinations

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Abstract

In most volume of distribution (V_D) determinations the drug partitioned in to erythrocytes (C_{ery}) occupying 45% of blood volume is disregarded. The V_D determinations can be erroneous on two accounts. The first is the indiscriminate reference to plasma (C_p), whole blood (C_b) or serum (C_s) concentrations. The second is when C_{ery} values are not considered in calculations. Isolated erythrocytes were incubated in plasma water (C_{pw}) represented by physiological saline drug solutions, the C_{pw}, C_{ery} and C_b values were experimentally determined *in vitro*. Aberrations to the V_D determinations are demonstrated using both theoretically and practically determined values of C_{pw}, C_{ery} and C_b. Widely varying V_D values 125 L to 2.55 L resulted when C_p data alone is used while the values differed marginally from 4.56 L to 5.53 L when C_b values were used for two setting using same amount of drug.

Key words: Volume of distribution, Erythrocyte drug concentration C_{ery},

Introduction

The present study highlights the repercussions of indiscriminate use of drug blood concentration (C_b), plasma concentration (C_p) and serum concentration (C_s). A plasma determination is sometimes referred to as blood concentration. The erythrocyte partitioned drug has so far evaded receiving due recognition[1]. This identifies a fourth concentration parameter, which is the erythrocyte concentration of drugs (C_{ery}). This parameter is occasionally mentioned in the literature[2]. The C_{ery} values are sometimes over five times higher than the $C_p$values[3].

Isolated erythrocytes were incubated *in vitro* setting with doxycycline[4], chloramphenicol, rifampicin, oxytetracycline and chloroquine solutions of known strength. The C_{ery} and C_{pw} values were determined using standard curves ('Determination of Uptake of Selected Drugs by Red Blood Corpuscles, B. Sc. Pharmacy, Department of Chemistry,