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A DIFFERENCE EQUATION OF BLOOD PHARMACOKINETICS MODEL

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Abstract: Mathematical models have received a growing interest as an applied activity in industry, e.g. in the construction and use of simulators in training and education of medical doctors, nurses and pharmaceutics. This Model assist the decision making process the patients' metabolism and infusion of medicine

Keywords: Mathematical Model, Pharmacokinetics

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INTRODUCTION

The Mathematical Model is the precise continuous samplings of new clinical data have generated experiments, from which one can gain new insights into the dynamics of physiological systems and not only into their steady state behavior patterns and the attempts to focus on precise definitions of physiological concepts in order to avoid confusion, misunderstandings and waste of efforts. In this paper to attempt the diffusion of drug in the blood stream is an example of exponential growth or decay process whose repetition at regular intervals. The drug kinetics or Pharmacokinetics is concerned with distribution of drugs i.e., the Blood circulatory system, the intestinal tract, tissues cells, and blood plasma.

FORMULATION OF A DIFFERENCE EQUATION MODEL

Suppose r is the drug is infused into blood stream of the patient at a constant period and is eliminated from the blood stream at a rate proportional to the amount of drug present at internals $n \quad (0 \le n \le \infty)$ Initially value the patients' blood contains no drug.

The amount of drug $u(n)$ in the blood stream of intervals $n \quad (0 \le n \le \infty)$

$$u(n+1) - (1-k)\,\mathrm{u(n)} = \mathrm{r} \qquad \text{.......................(1)}$$

*where k is a cons*tant

So the general solution of equation (1)

$$u(n) = \frac{(1-k)^n(-ck-kr+r)+(k-1)r}{(k-1)k} \qquad \text{..............(2)}$$

Since there is no drug initially present in the blood, we have $u(0) = 0$ so that

$$u(0) = \frac{(1-k)^o(-ck-kr+r)+(k-1)r}{(k-1)k} \qquad \text{..............(3)}$$

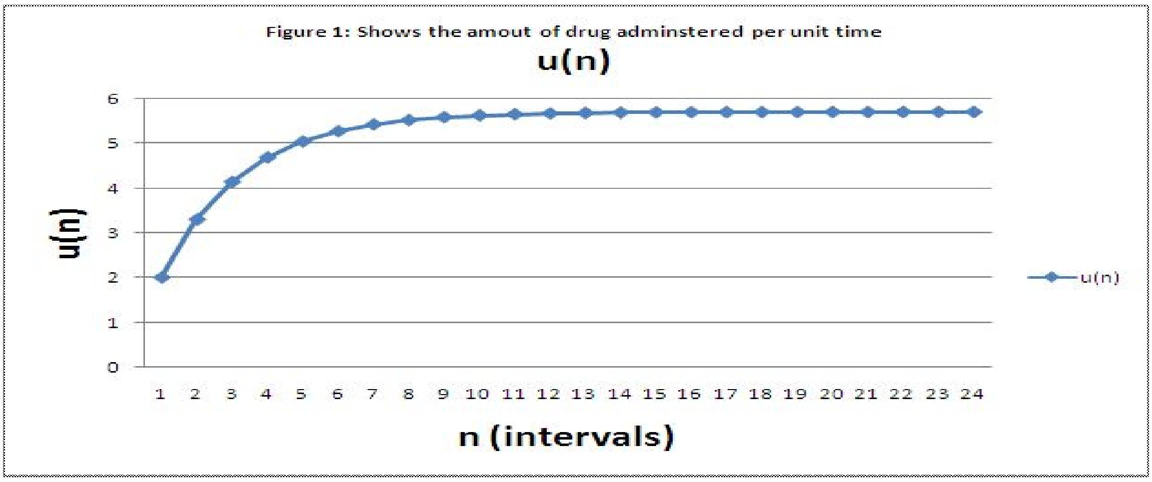
Thus $c = -r$, and

$$u(n) = \frac{r - r(1-k)^n}{k} \qquad \text{...........(4)}$$

Equation (4) was used for the hypothetical data. We assume that the elimination coefficient k depends on the patients' metabolism and not on the infusion intervals $n \quad (0 \le n \le \infty)$

Discussion of Results

Equation (4) shows that $u(n)$ approaches a constant value at $n \quad (0 \le n \le \infty)$, which is the steady state level of medication.



From the graph, the amount of drug administered in one hour for a sample of 2 mg of the drug in the blood at infusion rate at 2 mg per hour, the value of elimination coefficient k was obtained to be 0.35. From the Model, the amount of the medication that would be present after six hours and steady state level of medication was 5.05mg and 5.71mg respectively

The difference equation model is showing the adjustment of infusion rate given the steady-level of medication in the blood stream of patient.

CONCLUSIONS

From the graph (figuare1) initially at 1 interval(hour) the amount of drug absorbed is small and later gradually increasing, after 24 hours, it was found that the amount of drug in the body was found to be 5.71 mg

APPENDIX A

OUT RESULTS FROM THE EXCEL SHEET

n	$u(n)$
1	2
2	3.3
3	4.145
4	4.69425

5	5.051263
6	5.283321
7	5.434158
8	5.532203
9	5.595932
10	5.637356
11	5.664281
12	5.681783
13	5.693159
14	5.700553
15	5.70536
16	5.708484
17	5.710514
18	5.711834
19	5.712692
20	5.71325
21	5.713613
22	5.713848
23	5.714001
24	5.714101

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