



Pharmacokinetics

Bioavailability

Solved Problems

by G.S.N.K.Rao {Eswar}

PROBLEM-7:

AUC values of penicillin up on i.v administration of 50 mg and oral administration of 100 mg tablet were found to be 70 and 90 respectively.

Calculate:

- Absolute Bioavailability of penicillin.
- Relatively Bioavailability of penicillin from tablet based on penicillin suspension whose dose is 100 mg and AUC is 95.

SOLUTION-7:

a. Calculate Absolute Bioavailability of penicillin.

Given,

i.v. dose of penicillin, $D_{iv} = 50$ mg

Oral dose of penicillin tablet, $D_{oral} = 100$ mg

AUC of iv administered penicillin, $[AUC]_{iv} = 70$ mg. hr/lt

AUC of oral administered penicillin, $[AUC]_{oral} = 90$ mg. hr/lt

Absolute Bioavailability, $F = ?$

Formula:

$$\text{Absolute Bioavailability, } F = \frac{[AUC]_{oral} D_{iv}}{[AUC]_{iv} D_{oral}} \times 100$$

$$F = \frac{90 \times 50}{70 \times 100} = \frac{4500}{7000} = 0.64 \times 100 = 64\%$$

b. Calculate Relatively Bioavailability of penicillin from tablet based on penicillin suspension whose dose is 100 mg and AUC is 95.

Dose of penicillin tablet, $D_{test} = 100$ mg

Dose of penicillin suspension, $D_{std} = 100$ mg

AUC of penicillin tablet, $[AUC]_{test} = 90$ mg. hr/lt

AUC of penicillin suspension, $[AUC]_{std} = 95$ mg. hr/lt

Relative Bioavailability, $F_r = ?$

Formula:

$$\text{Absolute Bioavailability, } F_r = \frac{[AUC]_{test} D_{std}}{[AUC]_{std} D_{test}} \times 100$$

$$F_r = \frac{90 \times 100}{95 \times 100} = \frac{9000}{9500} = 0.95 \times 100 = 95\%$$

PROBLEM-8:

Following data is obtained for 4 formulations of pentoxyifylline in volunteers of average weight 50 kg.

Drug Product	Dose (mg/kg)	AUC (mg. hr/lt)
i.v. solution	1.2	450
oral solution	4.0	822
oral capsule	4.0	736
oral S.R. tablet	8.0	1040

SOLUTION-8:

Given data:

Drug Product	Dose (mg/kg)	Dose in mg /50kg	AUC (mg. hr/lt)
i.v. solution	1.2	$D_{i.v.} = 1.2 \times 50 = 60$	$[AUC]_{i.v.} = 450$
oral solution	4.0	$D_{sol} = 200$	$[AUC]_{sol} = 822$
oral capsule	4.0	$D_{cap} = 200$	$[AUC]_{cap} = 736$
oral S.R. tablet	8.0	$D_{SR} = 400$	$[AUC]_{SR} = 1040$

a. What is the absolute bioavailability of the drug from capsule?

$$F = \frac{[AUC]_{cap} D_{i.v.}}{[AUC]_{i.v.} D_{cap}} = \frac{736 \times 60}{450 \times 200} = \frac{44,160}{90,000} = 0.49 \times 100 = 49\%$$

b. What is the absolute bioavailability of the drug from S.R. tablet?

$$F = \frac{[AUC]_{S.R.} D_{i.v.}}{[AUC]_{i.v.} D_{S.R.}} = \frac{1040 \times 60}{450 \times 400} = \frac{62,400}{1,80,000} = 0.346 \times 100 = 34.6\%$$

c. What is the relative bioavailability of capsule against oral solution?

$$F_r = \frac{[AUC]_{cap} D_{sol}}{[AUC]_{sol} D_{cap}} = \frac{736 \times 200}{822 \times 200} = \frac{1,47,200}{1,64,400} = 0.895 \times 100 = 89.5\%$$

d. What is the relative bioavailability of S.R. tablet against oral solution?

$$F_r = \frac{[AUC]_{S.R.} D_{sol}}{[AUC]_{sol} D_{S.R.}} = \frac{1040 \times 200}{822 \times 400} = \frac{2,08,000}{3,28,800} = 0.632 \times 100 = 63.2\%$$

e. Which solid formulation shows better bioavailability?

Bioavailability of capsule (49%) is more than S.R. tablet (34.6%).

GOOD LUCK

Reference: Bio-Pharmaceutics and Pharmacokinetics by: Brahmankar
 : V. Venkateswarlu