

Pharmacokinetic Parameters from a Given Dataset

Practical 13 | Pharmacology III

Aim

To study Pharmacokinetic Parameters from a Given Dataset, and interpret the recorded observations.

Principle

- Time-concentration data support pharmacokinetic calculations only within the stated route and model. The one-compartment IV-bolus first-order model differs from oral absorption and multicompartment models.
- Choose the calculation or statistical model appropriate to the data structure and assumptions.
- Units, paired or independent observations, and the direction of the measured effect must be explicit.

Materials and Apparatus

- Provided concentration-time data, dose and route information, calculation/plotting software.
- Instructor-provided dataset and the stated study/model assumptions.
- Calculator or spreadsheet/statistical software and a record sheet.

Method

1. Confirm the route, dose, units and model assumptions stated with the data.
2. Plot concentration against time and inspect the proposed elimination interval.
3. For an appropriate log-linear interval, fit $\ln(\text{concentration})$ against time and obtain the elimination slope.
4. Calculate half-life and integrate the area under the curve with the chosen method.
5. Calculate clearance and apparent distribution measures only with the necessary route/model information.
6. Report parameters with units, assumptions and any extrapolated AUC portion.

Observation Record

Complete this record using actual laboratory findings or the provided teaching data.

Observation / parameter	Record / finding
Time	_____
Concentration	_____
Log concentration	_____
AUC intervals	_____
Model parameters	_____

Calculations and Interpretation

- For log-linear elimination: $\ln(C) = \ln(C_0) - kt$; half-life = $0.693/k$.
- Trapezoidal AUC interval = $(C_i + C_{i+1})/2 \times (t_{i+1} - t_i)$.
- When justified by terminal first-order data: residual AUC = C_{last}/k .
- After an IV dose, clearance = dose/AUC to infinity; for an oral dose without known bioavailability the result is CL/F .
- For the stated one-compartment IV-bolus model, $V = \text{dose}/C_0$ and clearance = kV .

Worked Illustration

Illustration: a valid elimination slope of -0.20 per hour gives $k = 0.20$ per hour and half-life = 3.47 hours.

The values in this illustration are for calculation practice.

Result

Record the actual finding, calculated value with units where relevant, and a conclusion supported by the observations.

Finding: _____

Conclusion: _____

Precautions

- Do not interchange paired and independent analyses.
- Keep unit conversions explicit and round at the final reporting stage.
- A model estimate or p-value does not by itself establish a causal or clinical conclusion.

Viva Questions

1. Why is oral dose/AUC called CL/F when F is unknown?

The observed exposure includes incomplete bioavailability, so clearance and bioavailability cannot be separated from that expression alone.

2. Why state assumptions?

An equation or test can give a misleading answer when its underlying assumptions do not hold.

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