Pharmacological Principles

Pharmacokinetics / Pharmacodynamics MCQs

1. Which of the following is >90% bound to plasma proteins?

    a. Atenolol
    b. Diazepam
    c. Gentamycin
    d. Lithium
    e. Theophylline

2. Which of the following has the largest volume of distribution?

    a. Digoxin
    b. Imipramine
    c. Lithium
    d. Chloroquine
    e. Trimethoprim

3. Which of the following has the shortest half life?

    a. Theophylline
    b. Diazepam
    c. Aspirin
    d. Lithium
    e. Digoxin

4. Which of the following is a phase one reaction?

    a. Reduction
    b. Acetylation
    c. Glucuronidation

d. Methylation
e. Sulphate conjugation

5. Clearance of which drug involves capacity limited elimination?

a. Theophylline
b. Gentamycin
c. Digoxin
d. Lithium
e. Phenytoin

6. An example of drugs that undergo chemical antagonism is

a. Insulin - glucagon
b. Protamine - heparin
c. Prednisone - glipizide
d. Morphine - naloxone
e. Phenoxybenzamine - prazosin

7. Regarding first order kinetics - all of the following are true EXCEPT

a. First order kinetics means rate of reaction is proportional to concentration
b. First order kinetics is more common than zero order kinetics
c. First order kinetics apply to exponential processes
d. First order kinetics generally apply to high plasma concentrations (>20 mg / 100 ml) of ethanol
e. First order kinetics result in steady state concentrations after multiple dosing.

8. Bioavailability is

a. The difference between the amount of drug absorbed and the amount excreted
b. The proportion of the drug in a formulation that is found in the systemic circulation
c. The AUC relating plasma concentration of drug to time after administration
d. Always identical with different formulations of the same drug

e. A measure of the rate of absorption of a drug

9. Which of the following drugs has a high extraction ratio?

a. Diazepam
b. Theophylline
c. Phenytoin
d. Warfarin
e. Propranolol

10. What is the half life of a drug with a volume of distribution of 700l/70kg and clearance of 49l/hour/70kg?

a. 5 hours
b. 7 hours
c. 10 hours
d. 12.5 hours
e. 15 hours

11. Regarding biotransformation

a. Phase one reactions always precede phase two reactions
b. Skin is an organ involved in drug biotransformation
c. Water conjugation is a phase one reaction
d. CYP2D6 accounts for the majority of P450 activity
e. Epoxidation is phase two biotransformation

12. Which of the following receptor - ligand pathway is correct?

a. Insulin - G protein receptor
b. Mineralocorticoid - tyrosine kinase receptor
c. Vitamin D - intracellular receptor
d. Adrenaline - ligand gated channel receptor
e. Platelet derived growth factor - cytokine receptor

13. Age associated changes in pharmacokinetics include

    a. Reduction in creatinine clearance in 2/3 population
    b. Decreased body fat
    c. Increase body water
    d. A greater reduction in conjugation compared with oxidation
    e. A decreased absorption related to age alone

14. The metabolic pathway of detoxification that become increasingly important in paracetamol toxicity is

    a. Conjugation with glucuronide
    b. Oxidation
    c. Reduction
    d. Methylation
    e. Cytochrome p450 dependent glutathione conjugation

15. You are given a vial with 15 ml of 0.5% prilocaine to do an arm block. How many mg of prilocaine are you injecting?

    a. 7.5 mg
    b. 15 mg
    c. 30 mg
    d. 50 mg
    e. 75 mg

16. Drugs that enhance other drug metabolism include all of the following EXCEPT

    a. Rifampicin
    b. Ketoconazole
    c. Phenobarbital
    d. Griseofulvin
    e. Phenytoin

17. Which is the safest to give in pregnancy?

    a. Lithium
    b. Phenytoin
    c. Gentamycin
    d. Heparin
    e. ACE inhibitors

18. Regarding pharmacology principles

    a. Diffusion is directly proportional to thickness and inversely proportional to surface area
    b. LD50 - 50% of the dose that kills most people
    c. Efficacy is the maximum response produced by a drug
    d. A partial agonist is always less potent than a full agonist
    e. EC50 = concentration of agonist that results in maximal response in 50% of patients

19. Reports of cardiac arrhythmias caused by unusually high blood levels of 2 antihistamines (terfenadine and astemizole) are best explained by

    a. Concomitant treatment with phenobarbital
    b. Use of these drugs by smokers
    c. Use of antihistamines by persons of Asian background
    d. A genetic predisposition to metabolise succinylcholine slowly
    e. Treatment of these patients with ketoconazole

20. Which of the following statements is correct?

    a. The half life is the time taken for a parameter to fall to 1/4 its original value
    b. Partial agonists act at receptor sites to cause maximal pharmacological effect at high doses
    c. Diazepam has a high extraction ratio and is thus subject to flow dependent elimination
    d. Morphine and pethidine have the same potency

e. A patient with oedema will have an increased volume of distribution of tobramycin

Answers: Pharmacokinetics / pharmacodynamics

1. B
2. D
3. C
4. A
5. E
6. B
7. D
8. B
9. E
10. C
11. B
12. C
13. A
14. E
15. E
16. B
17. D
18. C
19. E
20. E

1. What is the half life of a drug given: clearance = 8.4L/min; weight = 70kg; Vd = 5L/kg?

a. 24 hr
b. 12 hr
c. 30+ hr
d. ?
e. ?

2. With regard to a drug:

a. LD50 is 50% of the dose necessary to kill experimental animals
b. Efficacy is the maximum response produced by a drug
c. Spare receptors are present if Kc50 is the same as EC50
d. Potency is the same as affinity
e. TD50 is the concentration of a drug necessary to produce toxic effects 50% of the time

3. Half life

a. May not be a good indication of clearance
b. Does not increase with age
c. Is not dependent on Vd
d. ?
e. ?

4. 2mL of 0.5% wv is equal to

a. 1mg
b. 10mg
c. 100mg
d. 20mg
e. ?

5. What is an example of a phase II biotransformation?

a. Oxidation
b. Reduction
c. Glycolysis
d. ?
e. ?

6. Regarding enzyme induction

a. It is irreversible
b. It takes 4 months to develop
c. Causes increase in smooth endoplasmic reticulum
d. Causes increase in rough endoplasmic reticulum
e. ?

7. Clearance

a. Is proportional to liver blood flow
b. ?
c. ?

d. ?
e. ?

8. Regarding pharmacokinetics and pharmacodynamics

a. Diffusion is inversely proportionate to surface area and directly proportionate to thickness
b. The LD50 is 50% of the dose that kills most people
c. The LD50 is 50% of the dose at which toxicity occurs
d. Efficacy is the maximum response produced by a drug
e. ?

9. Regarding bioavailability

a. PR drugs have no first pass
b. Transdermal drugs have first pass
c. IV drugs undergo first pass
d. ?
e. ?

10. Volume of distribution

a. Is inversely proportional to clearance
b. Is measured in mg/L
c. Is used to work out the maintenance dose
d. Is high in warfarin
e. Is proportional to half life

11. 5mL of 2% wv is equal to:

a. 10mg
b. 100mg
c. 200mg
d. 20mg
e. 40mg

12. Volume of distribution

a. Is calculated by dividing the amount of drug by its clearance
b. If high suggests homogeneous distribution through tissues
c. If low suggests homogeneous distribution through tissues
d. Of aspirin is greater than that of pethidine
e. Of midazolam is greater than that of warfarin

13. The volume of distribution

a. Is less than 70L for fluoxetine
b. Is calculated by dividing rate of elimination by concentrarion
c. Is inversely proportional to half life
d. Is about 5L/kg for pethidine
e. Is affected by the route of drug administration

14. By limiting liver blood flow, cardiac disease might inhibit the metabolism of all of the following EXCEPT:

a. Verapamil
b. Labetalol
c. Propoxyphene
d. Lignocaine
e. Trimethoprim

15. The bioavailability of a drug

a. Must be 100% if given by inhalation
b. Is typically about 75% for IV administration
c. Is high if the drug is hydrophilic
d. Is equal to 1- the extraction ratio
e. Is 70% for orall administered digoxin

16. For a specific effect, drug A is more potent than drug B. It follows that:

a. Drug B is a partial agonist acting at the same receptor as drug A
b. Drug A causes a greater maximal effect than drug B
c. When present in identical concentrations, drug A causes a greater effect than drug B
d. Drug A has a lower ED50 than drug B
e. Drug B will have a steeper dose response curve than drug A

17. The volume of distribution of a drug:

a. Relates its dose to its clearance
b. Is not an apparent volume
c. If high, implies greater concentration of drug in extravascular tissue
d. If high, implies greater plasma protein binding of the drug
e. If high, implies easier clearance of the drug by haemodialysis in

overdose

18. Regarding receptors, the following statements are true EXCEPT:

a. Most are proteins
b. They largely determine quantitative relations between dose of a drug and pharmacologic effect
c. They are responsible for selectivity of a drug reaction
d. Mediate actions of pharmacologic antagonists
e. Spare receptors produce effect without the need for a drug

19. Regarding elimination kinetics, which statement is INCORRECT?

a. In first-order kinetics, the rate of elimination is directly proportional to drug concentration
b. Ethanol displays dose-dependent kinetics
c. In zero-order kinetics, the rate of elimination is constant
d. Most drugs display first-order kinetics
e. Phenytoin can display zero-order kinetics

20. For a drug that is present in a concentration 4 times its EC50

a. The time course of effect is linear, initially
b. The time course of effect will follow the exponential decline in concentration
c. Toxicity can be expected
d. All of the above may be true depending on the drug
e. Toxicity would not be expected

21. All of the following statements about spare receptors are correct EXCEPT:

a. Spare receptors are identical, in the absence of drug, to non spare receptors
b. Spare receptors do not bind drug when the maximal drug effect occurs
c. Spare receptors influence the sensitivity of the receptor system to the drug
d. Spare receptors activate the effector machinery of the cell without the need for a drug
e. Spare receptors may be detected by finding that the EC50 is less than the Kd for the agonist

22. Which of the following drug metabolising systems has been shown to differ in populations in genetically pre-determined ways?

a. Reductions

b. Acetylations of amines
c. Methylation
d. Glucuronidation
e. Sulfate conjugation

23. Regarding receptor action

a. High concentrations of an agonist can never surmount a competitive antagonist
b. Partial agonists do not occupy all receptor sites
c. EC50 refers to the clinical effect at 50% of the maximal dose
d. Second messengers explain “spare receptors”
e. B-blockers and adrenaline exhibit physiological antagonism

24. Half-life

a. Is inversely proportional to Vd (volume of distribution)
b. Is the time required to attain 50% of steady-state concentration
c. Is directly proportional to clearance
d. Is decreased in renal failure
e. Is decreased in hepatic failure

25. Regarding bioavailability

a. Rectal administration has the same first-pass effect as oral
b. Transdermal is up to 90%
c. IV administration is between 95 and 100%
d. Is reduced in digoxin when given orally because of bacterial metabolism
e. Can be calculated by the extence of absorption (f) multiplied by the extraction ratio (ER)

26. Regarding biotransformation

a. Phase I reactions lead to increased polarity for excretion by the liver
b. Phase I reactions occur solely in the liver
c. Phase I reactions must undergo phase II reactions in order to be renally excreted
d. Hydroxylation and deamination are examples of phase I reactions
e. Rarely leads to toxic metabolites

27. The potency of a drug

a. Refers to the concentration needed to produce maximal effects
b. Depends on the efficiency of drug-receptor interaction
c. Is the limit of the dose-response relation
d. Determines clinical efficacy
e. Determines its toxic side-effects

28. The volume of distribution

a. Is proportionately related to the concentration of crug in the body
b. Is high for those drugs retained in the vascular compartment
c. Is a measure of the apparent space available in the body to contain a drug
d. For chloroquine is much smaller than that of digoxin
e. None of the above

29. Phase II reactions in metabolic biotransformation include all of the following EXCEPT:

a. Water conjugation
b. Cytochrome P-450 dependent oxidations
c. Acetylation
d. Methylation
e. Glucuronidation

30. An example of a drug receptor includes:

a. Leukotriene-B (LTB)
b. Tubulin
c. Arachinodic acid
d. Fibronectin
e. Tumour necrosis factor -1

31. The volume of distribution of a drug

a. Related the amount of a drug in the body to its plasma concentration
b. Is large for a drug extensively bound to plasma proteins
c. Is large for aspirin
d. Never exceeds 42 litres
e. Is not affected by albumin concentration

32. Receptor antagonists

a. Prevent agonists from binding to antagonists
b. Progressively inhibit agonist response to decreasing concentrations of antagonist
c. Cannot be negated at high doses of agonists

d. Bind to the receptor and activate it
e. Inhibit receptors to a degree proportionate to antagonist concentration

33. Regarding second messengers

a. cAMP has no role in calcium homeostasis
b. cAMP exerts most of its effects by stimulating cAMP-dependent protein kinases
c. inhibition of adenylyl cyclase results in increased cAMP
d. phospholipase C is situated in the cell nucleus
e. phospholipase C catalyses IP3 into PIP2 and DAG

34. The volume of distribution of a drug:

a. Relates the amount of a drug in the body to its plasma concentration
b. Is large for a drug extensively bound to plasma proteins
c. Is large for aspirin
d. Never exceeds 42 litres
e. Is not affected by albumin concentration

35. Type I biotransformation reactions include:

a. Methylation
b. Acetylation
c. Oxidation
d. Glucuronidation
e. Sulphonation

Answers Pharmacological Principles

back

1. ?

2. b (Note from Marcus - I think e is also correct. Note from Louis – no e is borderline/ambiguous, the correct definition would be “to produce toxic effects in 50% of the subjects receiving it” – 50% of the time could apply to individuals)

3. ?

4. b

5. c (Note from Louis glyclolysis is not a phase II reaction, it is a 10 step

reaction glucose -> pyruvate. The phase II rections are glucuronidation, acetylation, glutathione conjugation, glycine conjugation, sulfation, methylation, water conjugation)

6. c

7. a

8. d

9. ? Note from Louis – probably B, transdermal is 80 to <100 BA (i.e. always some first pass)

10. e

11. b

12. e

13. d

14. e

15. e

16. d

17. c

18. e

19. b

20. a

21. d

22. b

23. d (Note from Marcus - d is certainly correct, but I think e may also be too) (Note from Louis – e is incorrect, this is **pharmacologic antagonism** – they compete for the same receptor. **Physiologic antagonism** is where drugs act on different receptors to stimulate different endogenous regulatory pathways with opposing effects – more difficult to control (e.g. glucocorticoids vs. insulin) and with **chemical antagonism** the antagonist will react directly with the drug (protamine +ve change binds to heparin –ve charge to counteract)

24. b

25. d

26. d

27. b

28. c

29. b

30. b

31. a
32. e
33. b
34. a
35. c

MCQs – Pharmacodynamics & Pharmacokinetics

May 2006

1. Which of the following drugs has an average half life of 50 hours?

    a. Nortriptylline
    b. Digoxin
    c. Trimethoprim
    d. Valproic acid
    e. Lithium

2. All of the following have 100% oral bioavailability EXCEPT

    a. Valproic acid
    b. Trimethoprim
    c. Digoxin
    d. Diazepam
    e. Lithium

3. All of the following drugs are >90% plasma protein bound EXCEPT

    a. Diazepam

b. Frusemide

c. Fluoxetine

d. Gentamicin

e. Warfarin

4. Which of the following drugs has a volume of distribution >2000 ℓ/70kg?

a. Aspirin

b. Imipramine

c. Digoxin

d. Propranolol

e. Chloroquine

5. What is the half life of a drug with a volume of distribution of 100ℓ/70kg and a clearance of 7ℓ/hr/70kg

a. 5 hours

b. 10 hours

c. 12.5 hours

d. 15 hours

e. 20 hours

6. All of the following drugs exhibit flow dependent elimination EXCEPT

a. Atenolol

b. Isoniazid

c. Propoxyphene

d. Amitriptylline

e. Lignocaine

7. Which of the following undergoes a phase I hydrolysis reaction? (biotransformation)

a. Ethanol

b. Naloxone

c. Morphine

d. Lignocaine

e. Diazepam

8. Which of the following undergoes acetylation in the liver? (Phase 2 biotransformation)

a. Isoniazid

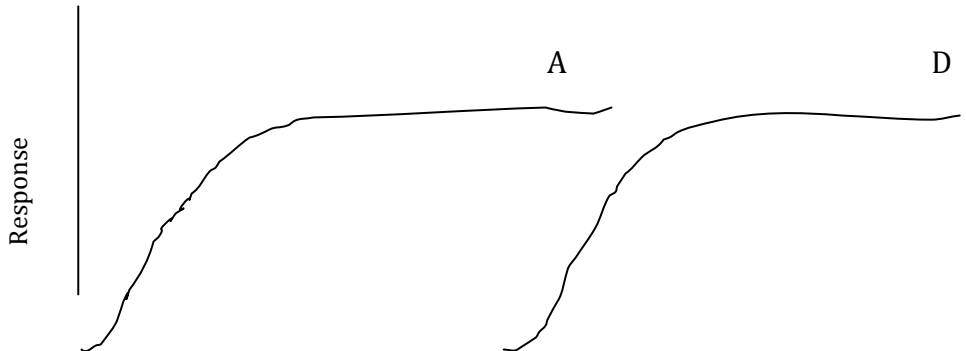
b. Acetaminophen

c. Salicylic acid

d. Epinephrine

e. Diazepam

9.



Which of these drugs is the most efficacious?

a. Drugs A and B

b. Drug C

c. Drugs A and D

d. Drugs D and C

e. Drug A

10. Referring to the graph in question 9 – which of the drugs is most potent?

a. A
b. B
c. C
d. D
e. A and B

11. EC50 is

a. Measured with a radioactive receptor
b. Always equal to Kd
c. Drug concentration with 50% receptors bound
d. Representation of the receptors affinity for drug binding
e. Drug concentration with 50% of maximal drug effect

12. Which of the following will NOT alter the volume of distribution of a drug?

a. Cardiac failure
b. Clearance
c. Age
d. Burns
e. Pleural effusion

13. Volume of distribution equals

a. Dose given/plasma concentration
b. Total amount of drug in the body/plasma concentration
c. Urine drug concentration/plasma concentration

d. Dose given/urine concentration

e. Urine drug concentration/plasma concentration

14. Which of the following drugs undergoes rate limited elimination?

a. Lignocaine

b. Morphine

c. Warfarin

d. Propanolol

e. Aspirin

15. Ligand gated channel receptors include all of the following EXCEPT

a. GABA

b. Aspartate

c. Glycine

d. Glutamate

e. Ach-muscarinic

16. Regarding receptor regulation

a. Receptor down regulation occurs over hours – days

b. Receptor responses to drugs often "desensitise" with time – this desensitisation is usually irreversible

c. The mechanism of agonist induced desensitisation of the nicotinic Ach receptor has been worked out in detail

d. All "internalised" receptors are degraded by lysosomes

e. None of the above are correct

17. Which of the following acts on intracellular receptors

a. Serotonin

b. Glucagon

c. Corticosteroids

d. GABA

e. Insulin

18. Which of the following has ↑ bioavailability in the neonate when compared with older children/adults?

a. Penicillin

b. Digoxin

c. Acetaminophen

d. Diazepam

e. Phenobarbital

19. First order kinetics

a. Means rate of reaction is proportional to concentration

b. Are more common than zero order kinetics

c. Apply to exponential processes

d. Generally apply to high plasma concentrations (>20mg/100ml) of ethanol

e. Result in steady state concentrations after multiple dosing

20. A single compartment model means that

a. One exponential term describes the decreasing plasma concentration of the drug

b. A single exponential term describes the rise in plasma concentration following oral administration

c. The drug does not penetrate tissues

d. The drug is restricted to the ECF

e. The drug is highly ionised

Answers – Pharmacodynamics & Pharmacokinetics

10 August 2004

1. B
2. C
3. D
4. E
5. B
6. A
7. D
8. A
9. C
10. A
11. E
12. B
13. B
14. E
15. E
16. A
17. C
18. A
19. D
20. A