UNIVERSITI SAINS MALAYSIA

PEPERIKSAAN PERTAMA
PROGRAM SARJANA FARMASI
SEMESTER 1 1993/94

NOVEMBER 1993

FCP 556.20 : BIOSTATISTICS, STUDY DESIGN AND CLINICAL PHARMACOKINETICS.

(2 HOURS)

This examination consists of **two sections** and 29 printed pages.

Section A consists of 50 multiple choice questions.

Section B consists of **two (2)** long questions.

Answer **ALL** questions.

Answers to Section A must be entered into the scripts provided.

...2/-

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Section A

Mark (/) all answers on the appropriate space corresponding to a correct or most appropriate answer for each question. Each question has only one correct or most appropriate answer or statement.

1. Which of the following side effects is uncommon in lithium therapy?

   ..... (a) Slurred speech.

   ..... (b) Nausea.

   ..... (c) Polyuria.

   ..... (d) Weight gain.

2. Which of the following statements regarding lithium clinical pharmacokinetic is/are true?

   (i) Lithium is not metabolized but it is excreted exclusively by renal route.

   (ii) Gastrointestinal absorption of conventional lithium carbonate tablets appear to be virtually complete (95% - 100%)

   (iii) In patients with normal sodium balance, lithium clearance is approximately 25% of creatinine clearance.

   (iv) Lithium distribution follows a one compartment model and it is imperative that sample for lithium be obtained at least 12 hours after the last dose.

   ..... (a) (i) and (ii) only.

   ..... (b) (i), (ii) dan (iii) only.

   ..... (c) (i), (ii), (iii) and (iv).

   ..... (d) (iv) only.

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3. Which of the following lithium serum levels is desired in prophylaxis of bipolar affective disorder?

..... (a) 0.6 - 1.2 mEq/L

..... (b) 0.2 - 0.4 mEq/L

..... (c) 1.2 - 1.5 mEq/L

..... (d) more than 2.0 mEq/L

4. A.L is a 35 years old, 65 kg, Indian male being treated for acute mania. He is receiving 300 mg of lithium carbonate at 9.00 am, 2.00 p.m and 9.00 p.m. His serum creatinine concentration is 0.9 mg/dl, calculate the value of AL's lithium clearance.

..... (a) 1.6 L/hr.

..... (b) 1.0 L/hr

..... (c) 3.0 L/hr.

..... (d) 2.2 L/hr.

5. Which of the following factors increases lithium serum concentration?

..... (a) Increased cardiac output.

..... (b) Decreased sodium intake.

..... (c) Acute phase therapy.

..... (d) Increased sodium intake.

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6. Which of the following statements regarding quinidine serum assay is true?

..... (a) Spectroscopic method of analysis is highly specific for quinidine.

..... (b) Liquid chromatographic method of analysis is able to separate and distinguish quinidine from dihydroquinidine.

..... (c) Commercial quinidine immunoassays, Emit and TDx, will be able to differentiate between quinidine and dihydroquinidine.

..... (d) O-desmethylquinidine do not cross-react with quinidine in serum quinidine analysis.

7. Which of the following statements regarding quinidine therapeutic drug monitoring is/are true?

(i) Therapeutic range for quinidine is highly dependent on the specificity of the assay used.

(ii) Trough level is more reliable than peak level in quinidine dosage adjustment.

(iii) Steady state concentration of quinidine should be obtained at least one day after the initial therapy.

(iv) Serum quinidine concentration decreases with concurrent administration of cimetidine.

..... (a) (i) and (ii) only.

..... (b) (i), (ii) and (iii) only.

..... (c) (i), (ii), (iii) and (iv).

..... (d) (iv) only.

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8. Which of the following statements describes excretion characteristic of quinidine?

..... (a) The excretion of quinidine by the kidneys accounts for 40% to 50% of the dose.

..... (b) Renal excretion occurs by glomerular filtration and is dependent upon the pH of the urine.

..... (c) Quinidine is significantly dialyzable by both peritoneal dialysis and hemodialysis.

..... (d) Quinidine exhibits dose-dependent pharmacokinetic as a result of nonlinear excretion.

9. Which of the following sets of quinidine salt - percent of base content is true?

..... (a) Quinidine Sulfate - 75%

..... (b) Quinidine gluconate - 62%

..... (c) Quinidine polygalacturonate - 40%

..... (d) Quinidine sulfate - 60%

10. Which of the following sets of drug-monitoring parameters is not true?

..... (a) Quinidine - renal function test.

..... (b) Quinidine - liver function test.

..... (c) Lithium - renal function test.

..... (d) Lithium - ECG.

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11. Which the following conditions is/are indication(s) for chloramphenicol therapy?

(i) Central nervous system infections with *H.Influenzae* type B.

(ii) Anaerobic infections of the pelvis.

(iii) Rickettsial disease.

(iv) *Pneumocystis carinii* pneumonia.

..... (a) (i) only.

..... (b) (i) and (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

12. Which of the following statements regarding chloramphenicol is/are not true?

(i) Its plasma concentration is monitored because of the high incidence of resistance of *Salmonella typhi*.

(ii) It is the drug of choice in the treatment of typhoid fever.

(iii) It is widely used to treat meningitis especially those caused by *Haemophilus influenzae* type b.

(iv) It exhibits large intra-and inter-patient variation in pharmacokinetics.

..... (a) (i) only.

..... (b) (i) and (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

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13. Which of the following statements regarding chloramphenicol (CMC) is/are **not** true?

(i) CMC palmitate is available in suspensions form.

(ii) CMC succinate is available in injections form.

(iii) The palmitate salt is hydrolysed by pancreatic lipase in duodenum.

(iv) Oral formulations generally result in less predictable plasma concentrations compared to the parenteral forms.

..... (a) (i) only.

..... (b) (i) and (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

14. Which of the following statements regarding chloramphenicol is/are **not** true?

(i) Absorption of the palmitate is less in neonates due to incomplete hydrolysis.

(ii) Area under the curve (AUC) of CMC palmitate is less than that of the base.

(iii) Absorption from IM is slow and incomplete resulting in delayed therapeutic response, typhoid relapse and is not recommended.

(iv) Oral doses need to be adjusted in patients with end stage renal disease.

..... (a) (i) only.

..... (b) (i) and (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

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15. Which of the following statements regarding chloramphenicol is/are **not** true?

(i) IV bioavailability is determined by hydrolysis in liver and transit time in blood.

(ii) The major route of elimination for the succinate is liver metabolism.

(iii) Bioavailability of succinate is increased in premature infants due to delayed elimination.

(iv) Bioavailability of parenteral succinate is lower than oral palmitate.

..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

16. Which of the following statements regarding chloramphenicol is **not** true?

(i) Its distribution is wide and is highest in the brain and CSF.

(ii) Its brain and CSF penetration is independent of meningeal inflammation.

(iii) 5-29% of administered CMC is recovered in urine.

(iv) The plasma concentration resulting from the intravenous administration is higher in renal impairment due to accumulation of succinate.

..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

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17. Which of the following statements concerning chloramphenicol therapy is/are **not** true?

(i) Gray baby syndrome usually occurs in infants on high doses.

(ii) Aplastic anemia may occur weeks or months after termination of therapy.

(iii) Infusion method is known to influence plasma chloramphenicol concentrations.

(iv) The widely accepted therapeutic range is a concentration of 10-20 ug/ml immediately before the dose.

..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

18. Which of the following statements regarding aminoglycoside therapy is **not** true?

..... (a) It is a mainstay in the treatment of serious systemic infections especially with gram-negative aerobic bacteria.

..... (b) It's effectiveness is dependent on active transport into bacterial cells and this is influenced by pH, divalent cations, osmolarity and oxygen tension.

..... (c) It is bacteriostatic, it acts on ribosome to produce nonfunctional proteins.

..... (d) Amikacin is derived from kanamycin and has activity against *Pseudomonas aeruginosa* and other gentamicin or tobramycin resistant organisms.

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19. Which of the following statements regarding aminoglycoside therapy is **not** true?

..... (a) Antibacterial activity of different agents does not differ but they show a marked difference in pharmacokinetic properties.

..... (b) It's antibacterial coverage includes aerobic gram-negative bacilli such as *E.coli*, Proteus spp, Enterobacter spp, Klebsiella spp Acinetobacter spp, Pseudomonas spp, Serratia spp and *S aerues*.

..... (c) All anaerobic bacteria are resistant toward aminoglycoside.

..... (d) Nephrotoxicity occurs in 12 to 25% of patients and is usually reversible.

Questions 20 to 23 refer to the following case :

MJ, (47 year old Malay, body weight 47 kg) with end-stage renal failure was admitted to the Intensive Care Unit of HUSM for pneumonia, septicemia and meningitis. His condition was serious but stable. After all the relevant specimens were taken for cultures and sensitivity, the following antibiotics were instituted:

Crystalline Penicillin-G	IV	4 Mega Unit Q 6 H
Gentamicin	IV	80 mg Q 8 H
Chloramphenicol	IV	1000 mg Q 6 H

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20. Which of the following statements regarding antibiotic therapy in the above patient is/are **not** true?

(i) Gentamicin does not enter the central nervous system.

(ii) The dosage regimen of gentamicin used would have resulted in a high trough concentration.

(iii) Both gentamicin and chloramphenicol act on bacterial ribosomes.

(iv) The dose of chloramphenicol does not require adjustment because it is eliminated in the liver.

..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

21. Which of the following statements regarding the antibiotic therapy in the above patient is/are **not** true?

(i) *In vitro* inactivation occurs when gentamicin is combined with chloramphenicol.

(ii) The aminoglycoside of choice in this patient should have been amikacin.

(iii) High single daily doses of gentamicin (400 mg Q 24 H) would have been appropriate in this patient with renal impairment.

(iv) Meningeal inflammation does not influence penetration of chloramphenicol into the meninges.

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..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

22. Which of the following tests is/are **of least importance** in monitoring antibiotic therapy of this patient?

(i) Blood urea.

(ii) Blood calcium.

(iii) Serum bilirubin.

(iv) Serum protein.

..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

23. Which of the following statements regarding antibiotic therapy in the above patient is/are **not** true?

(i) Ototoxic reactions that may be induced by amino glycosides in this patient include low frequency hearing loss, vertigo and tinnitus.

(ii) Gentamicin elimination in this patient would be expected to correlate very well with his renal function index.

(iii) The use of an appropriate normogram to adjust gentamicin doses would obviate the need to do blood gentamicin concentrations in this patient.

(iv) Urine output would be a poor indicator for gentamicin nephrotoxicity in this patient.

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..... (a) (i) only.

..... (b) (ii) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

24. A hospital pharmacist conducted a study to determine whether the frequency of 'inappropriate' prescribing decreased following the implementation of clinical pharmacy services. Data were collected on the number of 'appropriate' and 'inappropriate' prescribing situations before and after the initiation of the clinical services. Which of the followings is the best to test the null hypotheses?

..... (a) Pearson r.

..... (b) Student's t

..... (c) ANOVA

..... (d) Chi square

25. Which of the followings represents an assumption associated with parametric statistics?

..... (a) Homogeneity of variance

..... (b) Measures continuous and of equal intervals.

..... (c) Normality of data.

..... (d) All of the above alternatives.

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26. Which of the following statements regarding theophylline pharmacokinetic is true?

..... (a) When changing from an IV aminophylline infusion to an oral sustain-release dosage form of theophylline, the dose should be increased.

..... (b) The dose of theophylline should be based on lean body weight in an obese patient.

..... (c) Phenytoin, cimetidine and oral contraceptive pill can decrease theophylline elimination.

..... (d) The dose of theophylline should be reduced in patient with severe renal failure.

27. Which of the following statements regarding digoxin pharmacokinetics is true?

..... (a) Digoxin is totally excreted by the kidney.

..... (b) Digoxin is partially distributed in adipose tissue.

..... (c) When changing from a tablet to an elixir dosage form of digoxin, the dose should be reduced.

..... (d) Digoxin's clearance is affected by concomitant therapy with frusemide and procainamide.

Questions 28 to 32 refer to the following case.

KY is a 25 year old epileptic women who was referred to HUSM from a nearby district hospital for further evaluation and management of her seizures. The referral letter mentioned that she had been suffering from grand mal epilepsy since 15 years ago and her condition was moderately controlled with 200 mg of phenytoin. Two days ago, she was brought to the district hospital by her husband after suffering from 5 attacks within 24 hours prior to admission. At the district hospital, the phenytoin daily dose was increased to 300 mg but the number of attacks per day remains.

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28. Which of the following approach is the most appropriate for controlling K.Y. seizures?

..... (a) To stop phenytoin and substitute it with another antiepileptic drug.

..... (b) To continue the phenytoin and add another anti-epileptic drug.

..... (c) It is too early to tell whether the current phenytoin dose is sufficient. Wait until steady-state is achieved then check blood level and adjust dose accordingly.

..... (d) To load the patient with phenytoin and then maintain with the current maintenance dose.

29. If a decision is to substitute or add phenytoin, which of the following drug is least likely to be effective as the alternative?

..... (a) Phenobarbitone.

..... (b) Ethosuximide.

..... (c) Carbamazepine.

..... (d) Valproic acid.

30. If a decision is to wait until steady-state is achieved, how long will this be from the time the patient was admitted to HUSM?

..... (a) 1 day.

..... (b) 1 week.

..... (c) 2 weeks.

..... (d) 1 month.

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31. If a decision is to load the patient with phenytoin, how could this be best approached?

..... (a) Estimate the loading dose using the formula LD=CpVd where the Cp is the desired concentra tion and Vd is the volume of distribution.

..... (b) Just load the patient based on the standard LD of 18 mg/kg.

..... (c) Give half of the standard LD of 18mg/kg.

..... (d) Measure the blood concentration of phenytoin, then estimate the loading dose using the LD formula with the Cp equal to desired concentra- tion minus the measured blood concentration.

32. At steady state, the blood concentration was found to be 8 mg/l. A desired blood concentration of 15mg/l is set. Which of the following method can be applied to estimate the dose required?

..... (a) Bayesian.

..... (b) Mullen.

..... (c) Ludden.

..... (d) All of the above.

Questions 33 to 35 are refer to the following case.

A new dose was initiated and the blood level was again taken at steady-state. The steaday state blood concentration of phenytoin from a daily dose of 330mg was found to be 14mg/l. Since, KY seizures is still not fully controlled, a new target of 18mg/l is set.

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33. Based on Ludden's method, what is the value for Km of this patient?

..... (a) 2 mg/l.

..... (b) 4 mg/l

..... (c) 6 mg/l

..... (d) 8 mg/l

34. Based on Ludden's method, what is the value for Vmax of this patient?

..... (a) 325 mg/day.

..... (b) 350 mg/day.

..... (c) 375 mg/day.

..... (d) 400 mg/day.

35. Based on Ludden's method, what is the new dosage regimen needed to achieve a new steady-state concentration of 18mg/l?

..... (a) 340 mg/day.

..... (b) 370 mg/day

..... (c) 400 mg/day.

..... (d) 420 mg/day.

36. All of the following antiepileptic drugs except ..... may be initiated with a loading dose if seizures control needs to be achieved early.

..... (a) phenobarbitone.

..... (b) carbamazepine.

..... (c) phenytoin.

..... (d) valproic acid.

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37. Carbamazepine therapy was planned for a patient with generalised seizures. The pharmacist was asked to recommend the dosing regimen for the patient. The most appropriate recommendation would be .....

..... (a) to start with a loading dose, then continue with maintenance dose of 400mg q.i.d.

..... (b) not to give a loading dose and initiate therapy with 400mg q.i.d.

..... (c) to give a quarter of the maintenance dose in the first week, and increase by a quarter of the maintenance dose weekly until the full dose is reached.

..... (d) to give a quarter of the maintenance dose in the first week, then check blood level to determine the next dose required.

38. The half-life of carbamazepine is shorter when used chronically. A reasonable explanation for this is .....

..... (a) Michaelis-Menten kinetics.

..... (b) autoinduction.

..... (c) drug interaction.

..... (d) none of the above.

39. Which of the following is the most important feature of a good clinical trial?

..... (a) Randomization.

..... (b) Blinded.

..... (c) Prospective.

..... (d) Retrospective.

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40. The measure(s) of disease occurence may include .....

..... (a) incident rate.

..... (b) cummulative incidence.

..... (c) prevalence.

..... (d) all of the above.

41. Which of the following can be classified under observational study design that is analytical in its approach?

..... (a) Case reports.

..... (b) Case series.

..... (c) Incidence studies.

..... (d) None of the above.

42. A retrospective study is also known as a .....

..... (a) case-control study

..... (b) cohort study.

..... (c) cross-sectional study.

..... (d) disease frequency survey.

43. If an adverse effects is suspected to occur in one out of 30,000 subjects, how many subject is needed to be observed in order for the incidence to be 95% likely to occur?

..... (a) 60,000.

..... (b) 90,000.

..... (c) 120,000.

..... (d) 150,000.

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44. The results of scientific research .....

..... (a) should be made available for critique and replication.

..... (b) must comform to public expectations about the outcome.

..... (c) should not be used to support existing theories.

..... (d) must be obtained in controlled laboratory situations.

45. According to an astrologer, people born under a particular star sign are 'basically kind and very intelligent, although because of their modesty, not sufficiently appreciated by others'. To test the truth of his statement, the astrologer asks a group of individuals born under this star sign if this description fits their personality. 95% of the sample agrees that the description is accurate. One of the problems with this enquiry is.....

..... (a) in this case a 100% agreement is required for an acceptable evidence.

..... (b) astrology is inherently false, therefore the evidence must be wrong.

..... (c) it is contrary to the principles of controlled observation.

..... (d) 'personality' is inherently a misunderstood concept.

46. Which of the following statements regarding research planning is true?

(i) The use of correct research methods does not constitute an ethical necessity.

(ii) Some scientific research projects do not involve the testing of hypothesis.

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(iii) The population being studied is defined after a sample has been selected.

(iv) Experimental designs are more appopriate than non experimental designs for demonstrating causal relationship.

..... (a) (i) and (iii) only.

..... (b) (ii) and (iv) only.

..... (c) (i), (ii) and (iii) only.

..... (d) (iv) only.

47. If a pilot study indicates that the effect is likely to be small in relation to the sampling error then the investigator should .....

..... (a) use incidental method of sampling.

..... (b) abondan the research project.

..... (c) use a relatively small sample.

..... (d) use a relatively large sample.

48. If a well designed study demonstrates a convincing advantage of one therapeutic technique over another but is based on a sample of five people in the two groups, then the study is likely to have.....

..... (a) high external and internal validity.

..... (b) low internal and external validity.

..... (c) high external and low internal validity.

..... (d) high internal and low external validity.

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49. Which of the following aspect is a survey research similar to experimental research?

..... (a) The manipulation of the independent variable by the investigator.

..... (b) The assignment of subjects into the treatment groups.

..... (c) The selection of a representative sample from the population.

..... (d) Both (a) and (b)

50. If the internal validity of a study is adequate then.....

..... (a) the results could be generalize to other situations.

..... (b) the results will be clinically useful.

..... (c) the results will be statistically significant.

..... (d) the investigation may demonstrate causal effect.

(50 Marks)

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Section B

Question 1

AA is a 12 year old boy came to HUSM on 20th. October 1993 for his regular management of osteosarcoma. His osteosarcoma was first diagnosed last June at General Hospital, Kuala Lumpur and was referred to HUSM for "High-Dose Methotrexate" therapy. Review of system on 20th. October 1993 revealed no abnormalities except right knee swelling.

Laboratory result on 21st. October 1993 showed:

Na^+ : 135 mM/l, K^+ : 4.2 mM/l, Urea : 2 mM/l,
Glucose : 5 mM/l, WBC : $8 \times 10^3/mm^3$
RBC : $6 \times 10^6/mm^3$ and Plt : $110 \times 10^3/mm^3$

The high dose methotrexate (MTX) was given on 23rd. October 1993 as follow :

Patient BSA : $1.2\ m^2$
Dose of MTX : $6\ g/m^2$
Total dose MTX given : 7.2 g. IV.
Pre and post-hydration : perprotocol.
Allopurinol 200 mg p.o tds to prevent hyperurecemia.

(i) If the blood level of methotrexate post infusion are,

12 hr 70×10^{-7} mMolar

24 hr 20×10^{-7} mMolar

36 hr 7.8×10^{-7} mMolar

48 hr 4×10^{-7} mMolar

60 hr 2×10^{-7} mMolar

72 hr 1×10^{-7} mMolar

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a. Calculate the $t_{1/2}$ elimination of methotrexate in AA.

b. Explain the possible factor (s) that may affect the $t_{1/2}$ of methotrexate in AA.

(15 Marks)

(ii) Based on the following protocol for the leucovorin rescue:-

a. Calculate the dose of leucovorin required by AA.

b. Recommend the appropriate time to initiate and terminate the leucovorin rescue therapy in AA.

(10 Marks)

	Drug of Leucoverine				
Methotrexate concentration (mM/l)	36Hrs, (mg/m^2)	48Hrs, (mg/m^2)	72Hrs, (mg/m^2)	96Hrs. (mg/m^2)	>96 hrs. (mg/m^2)
> 10	12 q 4	50 q 4	200 q 4	200 q 4	200 q 4
> 5	12 q 4	12 q 4	100 q 4	200 q 4	200 q 4
> 1	12 q 4	12 q 4	50 q 4	100 q 4	200 q 4
> 0.5	12 q 4	12 q 4	12 q 4	50 q 4	100 q 4
> 0.2	12 q 4	12 q 4	12 q 4	12 q 4	50 q 4
> 0.2	-	-	-	-	-

...25/-

Question 2

A. Write short notes on the following :

(i) The criteria for the selection of a statistical test.

(2 Marks)

(ii) The five (5) common errors in the use of statistical methods in published research articles.

(5 Marks)

(iii) The differences between statistical and clinical significance of a statistical test?

(5 Marks)

B. (i) A pharmacist working in a hypertension clinic is interested to study the efficacy of a new antihiperten sive (drug X). He wants to compare the effectiveness between drug X and drug A, which is commonly used in the clinic. Suggest an experimental design that would control all the threats to internal validity that the pharmacist could employ. Also discuss the steps that would be involved in the suggested design.

(7 Marks)

(ii) What are the principles and aims in assesing or evaluating an original scientific report? Discuss the guidelines for the evaluation of this reports.

(6 Marks)

...26/-

Appendix

Normal Laboratory Values

1.	Ammonia	80 - 110 mcg/dl or	47 - 65 umol/L
2.	Amilase	4 - 25 IU/ml	
3.	Billirubin		
	- Direct	0 - 0.2 mg/gl	0 - 3 umol/L
	- Indirect	0.2 - 0.8 mg/dl	30 - 14 umol/L
	- Total	0.2 - 1 mg/dl	30 - 17 umol/L
4.	CO_2	20 -30 mEq/L	24 - 30 mMol/L
5.	pCO_2	35 - 45 mmHg	
6.	CI	100 - 106 mEq/L	100 - 106 mMol/L
7.	CpK	50 - 170 U/L	
8.	Creatinine (SCr)	0.6 - 1.5 mg/dl	60 - 130 umol/L
9.	Random blood sugar	70 - 110 mg/dl	3 - 10 umol/L
10.	Iron	50 - 150 mcg/dl	9.0 - 26.9 umol/L
11.	Lactic dehydrogenase	70 - 210 IU/L	
12.	Magnessium	1.5 - 2.0 mEq/L	0.8 - 1.3 mMol/L
13.	pO_2	75 - 100 mmHg	
14.	pH	7.35 - 7.45	
15.	Acid phosphatase		
	Male	0.13 - 0.63 IU/ml	36 - 176 nmol/s^{-1}/L
	Female	0.101- 0.65 IU/ml	2.8-156 nmol s^{-1}/L
16.	Alkaline phosphatase	39 - 117 IU/L	
17.	Phosphorous	3.0 - 4.5 mg/dl	1.0 - 1.5 mMol/L
18.	Potassium (K+)	3.5 - 5.0 mEq/L	3.5 - 5.0 mMol/L
19.	Calcium (ca^{2+})	8.5 - 10.5 mg/dl	2.1 - 2.6 mMol/L
20.	Sodium (Na+)	135 - 145 mEq/L	135 - 145 mMol/L
21.	Bicarbonate (HCO_3-)	24 - 38 mEq/L	24 - 28 mMol/L

...27/-

22.	Protein		
	- Total	6.0 - 8.5 g/dl	60 - 85 g/L
	- Albumin	3.5 - 5.0 g/dl	35 - 50 g/L
	- Globulin	2.3 - 3.5 g/dl	23 - 35 g/L
	- Transferrin	200 - 400 mg/dl	2.0 - 9.0 g/L
23.	Transaminase (SGOT)	0 - 40 IU/L	0 - 0.32 umol S^{-1}/L
24.	BUN	8 - 25 mg/dl	2.9 - 8.9 mMol/L
25.	Uric Acid	3 - 7 mg/dl	0.18 - 0.42 mMol/L
26.	Blood Pictures		
	Red blood cell (RBC)		
	Male	4.8 - 6.4 X $10^6/mm^3$	
	Female	4.2 - 5.4 X $10^6/mm^3$	
	White blood cell (WBC)	4.0 - 11.0 X $10^3/mm^3$	
	P	60 - 75%	
	L	20 - 40%	
	M	4 - 8%	
	B	0 - 1%	
	E	1 - 3%	
	Platelate (PIt)	200 - 400 X $10^3/mm^3$	
27.	ESR Male	0 - 10 mm/jam (Wintrobe)	
	Female	0 - 15 mm/jam (Wintrobe)	
28.	Hematocrit		
	Male	45 - 52%	
	Female	37 - 48%	
29.	Hemoglobine (Hgb)		
	Male	13 - 18 g/dl	
	Female	12 - 16 g/dl	
30.	Prothrombin time (PT)	75 - 100% nilai asas	
31.	APTT	25 - 37 saat	
32.	Creatinine Clearance (CrCI)	105 - 150 ml/min/1.73 m^2	
33.	TT_4	3.0 - 7.5 mcg/dl	
34.	RT_3U	25 - 35%	
35.	FTI	1.3 - 4.2	

..28/-

NORMAL HEMODYNAMIC VALUES AND DERIVED INDICES

Hemodynamic Parameters		Normal Value	Units
BP S/D/M	Blood Pressure Systolic/Diastolic/Mean	120/80/93	mm Hg
CO	Cardiac Output	4 - 6	Liters/min.
RAP	Right Atrial Pressure (Mean)	2 - 6	mm Hg
PAP S/D/M	Pulmonary Artery Pressure Systolic/Diastolic/Mean	25/12/16	mm Hg
PCWP	Pulmonary Capillary Wedge Pressure (mean)	5 - 12	mm Hg
CI	Cardiac Index	2.5 - 3.5	Liters/min/m^2
	$CI = \frac{CO}{\text{Body Surface Area}}$		
SV	Stroke Volume	60 - 80	ml/beat
	$SV = \frac{CO}{\text{Heat Rate}}$		
SVI	Stroke Volume Index	30 - 50	ml/beat/m^2
	$SVI = \frac{SVI}{\text{Body Surface Area}}$		
PVR	Pulmonary Vascular Resistance	< 200	dynes.sec.cm^{-5}
	$PVR = \frac{MPAP - PCWP}{CO} \times 80$		

...29/-

Hemodynamic Parameters		Normal Value	Units
TPVR	Total Peripheral Vascular Resistance	900 - 1400	dynes.sec.cm^{-5}
	$TPVR = \frac{MBP - RAP}{CO} \times 80$		
LVSWI	Left Ventricular Stroke Work Index	35- 80	gm-m/m^2/beat
	LVSWI = (MBP - PCWP) (SVI) (.0136)		

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