

UNIVERSITI SAINS MALAYSIA

PEPERIKSAAN KEDUA

PROGRAM M. PHARM.

SEMESTER II 1992/93

APRIL 1993

FCP 552 : FARMAKOTERAPEUTIK II

(2 HOURS)

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This examination consists of two sections.

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.

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**SECTION A**

1. Which of the following agents is/are implicated in drug-induced nephrotoxicity?

- (i) Radiocontrast agents.
- (ii) Cardiac glycosides.
- (iii) Non-steroidal anti-inflammatory agents (NSAID).
- (iv) Sulphonylurea.

- ..... (a) (i) and (iii) only.
- ..... (b) (ii) and (iv) only.
- ..... (c) (i), (ii) and (iii) only.
- ..... (d) (iv) only.

2. In the treatment of drug-induced acute interstitial nephritis, steroids should be administered if spontaneous recovery does not occur within ..... withdrawal of the offending drug.

- ..... (a) 5 days
- ..... (b) 10 days
- ..... (c) 15 days
- ..... (d) 20 days

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3. Which of the following aminoglycosides is the most nephrotoxic?

- ..... (a) Streptomycin.
- ..... (b) Gentamicin.
- ..... (c) Tobramycin.
- ..... (d) Neomycin.

4. Which of the following statements is/are true?

- (i) Extracellular fluid compartment consists of plasma and interstitial fluid.
- (ii) Total body water is a percentage of body weight.
- (iii) The major extracellular fluid anion is chloride.
- (iv) The major intracellular fluid cation is potassium.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv) only.
- ..... (d) (iv) only.

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5. Which of the following is/are not the function of the kidneys?

- (i) Inactivation of Vitamin D.
- (ii) Production of erythropoietin.
- (iii) Storage of glycogen.
- (iv) Secretion of antidiuretic hormone.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

6. Which of the following statements regarding renal blood flow is/are true?

- (i) Hydrostatic pressure is higher in glomerular capillaries than in renal vein.
- (ii) Reduction of renal blood flow is associated with decreased secretion of renin.
- (iii) Oncotic pressure of plasma albumin will retain fluid within the capillary.
- (iv) Autoregulatory mechanisms maintain the glomerular filtration rate.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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7. Which of the following statements is/are true?

- (i) Glomerular filtration rate (GFR) is reduced in the elderly.
- (ii) GFR is measured by the collection of 24 hours urine.
- (iii) Plasma creatinine level varies with dietary protein intake.
- (iv) Blood urea level depends on lean body mass.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

8. Which of the following is not a cause of acute renal failure?

- ..... (a) Hemorrhage.
- ..... (b) Septicemia.
- ..... (c) Amphotericin B.
- ..... (d) Minimal-change nephrotic syndrom.

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9. Which of the following is/are appropriate as an urgent treatment of hyperkalemia?

- (i) Intravenous calcium.
- (ii) Glucose and insulin infusion.
- (iii) Sodium infusion.
- (iv) Aluminium hydroxide tablet.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

10. Which of the following statements regarding the management of renal failure is/are true?

- (i) The use of loop diuretics should only be considered after a full volume replacement.
- (ii) Protein intake should be restricted.
- (iii) Dialysis is indicated if serum potassium is more than 7.0 mmol/L.
- (iv) Daily weight and fluid balance provide an assessment of body fluid.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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11. Which of the following statements regarding chronic renal failure (CRF) is/are true?

- (i) Chronic glomerulonephritis is the commonest cause.
- (ii) The hyperkalemia triggers the secretion of converting enzyme inhibitors.
- (iii) The use of glibenclamide is contraindicated.
- (iv) The use of aminoglycosides is contraindicated.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

12. Which of the following is/are cause(s) of anemia in chronic renal failure?

- (i) Reduced RBC survival.
- (ii) Gastrointestinal bleeding.
- (iii) Bone marrow depression.
- (iv) Edema.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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13. Which of the following statements regarding renal bone disease is/are true?

- (i) It is due to the failure of the kidney to convert cholecalciferol to 1, 25-(OH)<sub>2</sub>-cholecalciferol.
- (ii) Serum alkaline phosphatase is elevated.
- (iii) It can be treated with 25-(OH)-cholecalciferol.
- (iv) It gives rise to rickets in adults.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

14. Which of the following is/are true regarding the therapy of CRF?

- (i) Hyperphosphatemia is treated with calcium carbonate.
- (ii) Restricting fluid to 400 ml plus the previous day urine output will avoid volume overload.
- (iii) Hypercalcaemia is treated with resorbinum A.
- (iv) Subcutaneous erythropoietin is useful to treat the anemia.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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15. Which of the following is/are true regarding the management of nephrotic syndrome?

- (i) Salt intake should be restricted.
- (ii) Water intake needs not be restricted in stable patients.
- (iii) Diuretic is safe to reduce edema.
- (iv) Caloric intake should be reduced.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

16. Which of the following is/are complication(s) of nephrotic syndrome?

- (i) Cellulitis.
- (ii) Thrombosis.
- (iii) Hypercholesterolemia.
- (iv) Acute renal failure.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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17. Which of the following conditions is/are likely to respond to both steroid and cytotoxic therapy?

- (i) Minimal-change nephrotic syndrom.
- (ii) Wegner's Granulomatoses.
- (iii) Henoch Schoelein syndrom.
- (iv) Focal segmental glomerulosclerosis.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

18. Which of the following is/are cause(s) of nephrotic syndrome?

- (i) Penicillamine.
- (ii) Captopril.
- (iii) Infective hepatitis.
- (iv) Hypertension.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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19. Which of the following is the commonest cause of nephrotic syndrome in adults?

- ..... (a) Membranous nephropathy.
- ..... (b) Minimal-change disease.
- ..... (c) Systemic lupus erythematosus.
- ..... (d) Diabetes mellitus.

20. Which of the following is/are true regarding antihypertensives and the kidney?

- (i) Beta-blockers directly reduce renin release.
- (ii) Aldosterone antagonist acts on the distal tubule.
- (iii) Angiotensin-converting-enzyme inhibitors inhibit the production of angiotensin I.
- (iv) Nifedipine is contraindicated.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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21. Which of the following problems is/are more suggestive of nephrotic rather than nephritic syndrome?

- (i) Hematuria.
- (ii) Hypertension.
- (iii) Oliguria.
- (iv) Hypocholesterolemia.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

22. Which of the following statements regarding nephrotic syndrome is/are true?

- (i) Serum creatinine is elevated.
- (ii) The interstitial compartment is expanded.
- (iii) Renin secretion is reduced.
- (iv) The glomeruli are inflamed.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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23. Which of the following statements regarding symptoms of renal disease is/are true?

- (i) Renal colic is commonly due to renal stone.
- (ii) Dysuria means painful urination.
- (iii) Urgency implies a sudden urge to pass urine.
- (iv) Frequency means frequent passage of urine.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

24. Which of the following statements regarding acute glomerulonephritis is/are true?

- (i) It is commonly seen within 10 days after a beta-hemolytic streptococcus infection.
- (ii) It can lead to renal failure.
- (iii) It is usually presented as nephrotic syndrome.
- (iv) It is more common in adults.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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25. Which of the following statements is/are true?

- (i) Enuresis is the involuntary and unplanned emptying of a partially full bladder.
- (ii) Rifampicin colours the urine red.
- (iii) Oliguria is a condition when urine output falls below 400 ml/day.
- (iv) Hematuria is the presence of blood in the urine.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

26. Which of the following statements regarding the action of diuretics in the tubule is/are true?

- (i) Carbonic anhydrase inhibitors block the sodium/hydrogen exchange in the proximal tubule.
- (ii) Spironolactone inhibits the sodium/potassium exchange in the distal tubule.
- (iii) Thiazide blocks the sodium and chloride active transport.
- (iv) Amiloride blocks the action of aldosterone.

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- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

27. Which of the following processes is/are cause(s) of hypertension in renal failure?

- (i) Volume expansion.
- (ii) Increased renin secretion.
- (iii) Increased catecholamine secretion.
- (iv) Increased ADH secretion.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

28. Which of the following statements are true regarding patient with renal failure?

- (i) Maintenance of low blood urea and serum creatinine is important to reduce mortality.
- (ii) Adequate carbohydrate intake may reduce the requirement for dialysis.
- (iii) Early and frequent dialysis are generally not recommended in acute renal failure.
- (iv) Nutrition therapy is not important in renal failure.

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- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv) only.

29. Which of the following is/are constituent(s) of the dialysis fluid?

- (i) Sodium.
- (ii) Calcium.
- (iii) Magnesium.
- (iv) Antibiotic.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

30. Which of the following problems is/are risk(s) of hemodialysis?

- (i) Hypotension.
- (ii) Bleeding.
- (iii) Infection.
- (iv) Pericarditis

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- ..... (a) (i) and (ii) only.
  - ..... (b) (i), (ii) and (iii) only.
  - ..... (c) (i), (ii), (iii) and (iv).
  - ..... (d) (iv) only.
31. Which of the following problems is/are risk(s) of peritoneal dialysis?
- (i) Peritonitis.
  - (ii) Protein loss.
  - (iii) Hypotension.
  - (iv) Pleural effusion.
- ..... (a) (i) and (ii) only.
  - ..... (b) (i), (ii) and (iii) only.
  - ..... (c) (i), (ii), (iii) and (iv).
  - ..... (d) (iv) only.
32. Which of the following is an advantage of peritoneal dialysis?
- ..... (a) It is simple.
  - ..... (b) It is cheap.
  - ..... (c) It has lower risk of haemorrhage.
  - ..... (d) It is suitable for hypercatabolic state.

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33. Which of the following drugs is/are effectively removed by hemoperfusion?

- (i) Paracetamol.
- (ii) Paraquat.
- (iii) Gentamicin.
- (iv) Salicylic acid.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

34. Which of the following immunosuppressive agents is/are used to prevent rejection in renal transplantation?

- (i) Cyclophosphamide.
- (ii) Anti-lymphocyte globulin.
- (iii) Interferon.
- (iv) Interleukin.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (iv) only.

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35. Which of the following drugs needs a dosage adjustment in a patient with creatinine clearance of 10 ml/min?

- ..... (a) Erythromycin.
- ..... (b) Nafcillin.
- ..... (c) Amoxicillin.
- ..... (d) Chloramphenicol.

36. Which of the following is not the basis of a nomogram dosage adjustment?

- ..... (a) The drug follows dose-independent kinetics.
- ..... (b) The drug hepatic clearance does not change in uremic states.
- ..... (c) There is no variability of pharmacologic response in uremic states.
- ..... (d) The drug metabolite(s) is(are) inactive.

37. What is the creatinine clearance for an adult male with a serum creatinine of 220  $\mu\text{mol/l}$ ?

- ..... (a) 28 ml/min.
- ..... (b) 38 ml/min.
- ..... (c) 48 ml/min.
- ..... (d) 58 ml/min.

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38. Which of the following is not a major life threatening problem occurring within 1-2 weeks of acute glomerulonephritis?
- ..... (a) Acute renal failures.
  - ..... (b) Hypocalcemia.
  - ..... (c) Acid base abnormalities.
  - ..... (d) Hypertension.
39. Which of the following is true regarding the therapy of acute glomerulonephritis (AGN)?
- ..... (a) Protein intake should be reduced, at least initially.
  - ..... (b) Glucose intake should be increased to minimise catabolism.
  - ..... (c) Chlorothiazide is indicated for its comparatively potassium sparing property (compared to frusemide).
  - ..... (d) Calcium carbonate, dextrose-insulin and sodium bicarbonate are all suitable for the acute treatment of hyperkalemia.
40. Which of the following statements is true?
- ..... (a) Penicillin is indicated for all patient with AGN.
  - ..... (b) Erythromycin would be a suitable choice for patients sensitive to penicillin.
  - ..... (c) Potassium binding resin can cause hyponatremia.
  - ..... (d) The organism most commonly associated with the development of AGN is Staph.aureus.

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41. Which of the following are not characteristics of nephrotic syndrome?

- (i) Serum creatinine is markedly elevated.
- (ii) It is mainly a disease of the adult.
- (iii) It is generally a fatal disease.
- (iv) There is a variable degree of tendency for edema.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv).

42. Which of the following is not true about nephrotic syndrom?

- ..... (a) There is an increased tendency for staphylococcus infection.
- ..... (b) Steroid responsiveness is a good prognostic indicator.
- ..... (c) The disease most commonly seen in children is Nil disease.
- ..... (d) Cytotoxic may be useful for its steroid sparing effect.

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43. Which of the following statements are true about nephrotic syndrom?

- (i) The use of steroid may be associated with an increased risk of infection.
- (ii) Infective complication usually involves Klebsiella, pneumococcus and H. Influenza.
- (iii) The presence of renal impairment is associated with poor prognosis.
- (iv) Hypotension may result from contracted intravascular volume.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv).

44. Which of the following is not an appropriate therapy for nephrotic syndrom?

- ..... (a) Sodium restricted diet.
- ..... (b) Frusemide for a patient with fluid overload and good urine output.
- ..... (c) Albumin for a patient who is hypovolemic.
- ..... (d) Hypotensive agent for a patient with a diastolic blood pressure of 110 mm Hg.

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45. Which of the following statements are true?

- (i) AGN is characterised by a sudden onset of hematuria, edema and hypertension after about of infection with certain microorganism.
- (ii) Post-streptococcus glomerulonephritis is a cause of nephrotic syndrom.
- (iii) Cytotoxic agent is ineffective in a nephrotic patient with relapse on steroid.
- (iv) Primary glomerular disease is the cause of nephrotic syndrom in the majority of patients.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv) only.

46. Which of the following statements are true about acute renal failure?

- (i) Fluid boluses are appropriate in a patient who develops renal failure after a motor vehicle accident.
- (ii) Dialysis is indicated to treat fluid overload, acidosis and hyperkalemia.
- (iii) Fluid intake in adults should be increased to 3 l/day prior to dialysis.
- (iv) Frusemide may induce diuresis in a patient with oliguria due to acute tubular necrosis.

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- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv) only.

47. Which of the following statements are true?

- (i) Hyperkalemia should only be treated if there are ECG evidence and biochemical confirmation.
- (ii) Calcium chloride is a suitable treatment for hyperkalemia.
- (iii) Sodium polystyrene sulphonate is contraindicated in children.
- (iv) Dialysis is the treatment of choice for refractory severe fluid overload and electrolyte abnormalities.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv) only.

48. Which of the following statements regarding renal failure are true?

- (i) Treatment of acidosis can lower serum potassium.
- (ii) Insulin only shifts the potassium from extra to intracellular compartment without any effect on total body potassium.
- (iii) Sodium polystyrene sulfonate exchanges 2 moles of sodium for every mole of potassium.
- (iv) The cause of renal failure in a patient with ascites is likely to be renal hypoperfusion.

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- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv) only.

49. Which of the following statements are true?

- (i) There is no limit on the amount of frusemide that can be used to induce diuresis in acute oliguria.
- (ii) The most common cause of intrarenal ARF are prolonged pre-renal azotemia and exposure to nephrotoxic agents.
- (iii) Oliguria is defined as urine output of less than 1 l/24 hour.
- (iv) Mild to moderate hypertension may occur in a patient with prolonged oliguria.

- ..... (a) (i) and (ii) only.
- ..... (b) (i), (ii) and (iii) only.
- ..... (c) (i), (ii), (iii) and (iv).
- ..... (d) (ii) and (iv) only.

50. Which of the following statements is true?

- ..... (a) Anemia is only present in chronic renal failure.
- ..... (b) The most common cause of death in acute renal failure is the acute renal failure itself.
- ..... (c) Hypertension is unusual in early acute renal failure.
- ..... (d) The presence of hypertension in renal failure is associated with poor prognosis.

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**SECTION B**

**Question 1**

A 51 year old Malay lady was admitted to Hospital Universiti Sains Malaysia for the complaints of progressive abdominal distension, ankle edema, shortness of breath with orthopnea and paroxysmal nocturnal dyspnea and cough, weight loss and interrupted sleep pattern. She also noted that her urine volume was progressively becoming less.

Physical examination revealed a small patient (weight 40 kg) who was evidently pale. Blood pressure was 250/150 mmHg, pulse rate 100/minute; respiratory rate 34/min and temperature 38.9°C. Lung examination was significant for bibasilar crepitations with reduced air entry in both lungs. Jugular venous pressure (JVP) was elevated but heart examination did not revealed any other abnormality. Edema was noted in both ankles and extended to the thigh.

Initial lab tests revealed a serum sodium of 128 mmol/l, Urea of 11.7 mmol/l and potassium of 6.2 mmol/l. Hemoglobin was 7.35% and total white blood cell was 23,000/mm<sup>3</sup>.

Initial impression :

1. Renal impairment with hyperkalemia.
2. Hypertension.
3. Congestive cardiac failure.
4. Anemia.
5. Septicemia?  
Urinary tract infection (UTI) ?  
Bronchopneumonia.

The following treatment was then decided :

1. Frusemide 20 mg IV BD.
2. Nifedipine 10 mg PO stat and TDS.
3. Tab. ferrous sulphate 200 mg TDS.
4. Tab. folic acid 10mg QD.
5. Cloxacillin 500 mg IV Q 6 (H).
6. Gentamicin 60 mg IV TDS.

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A. Based on the diagnosis of renal impairment, explain how the following occurred.

- (i) Ankle edema.
- (ii) Paroxysmal nocturnal dyspnea.
- (iii) Oliguria.
- (iv) Hypertension.
- (v) Anemia.

(15 Marks)

B. Comment on the use of frusemide in this patient.

( 3 Marks)

C. Comment on the use of gentamicin in this patient.

( 3 Marks)

D. Describe how you would treat the problem of hyperkalemia in this patient.

( 4 Marks )

### Question 2

A six-year old boy was admitted for the complaint of a generalized body swelling of one week duration. The swelling was associated with the passing of frothy urine. On examination, the face was found to be puffy and there was a gross edema of the legs. Pulse rate was 80/min and blood pressure was 100/60 mmHg. Ascites was present. Other examinations were within normal limits.

Urine microscopic examination revealed a +++ protein but without red blood cells. 24 hour urine protein was 20g.

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A. What is the most likely problem of this patient?

( 1 Mark )

B. State the most likely cause of the patient's problem.

( 1 Mark )

C. List the relevant drug history that you would seek in this patient.

( 3 Marks )

D. Describe the pathophysiology of edema in this patient.

( 5 Marks )

E. Discuss your approach to the management of this patient under the following titles.

(i) General management.

(ii) Management of complications.

(iii) Specific management.

( 10 Marks )

F. What would your approach be if the disease recurs after responding well to your treatment?

( 5 Marks )

AppendixNormal Laboratory Values

1.	Ammonia	80-110 mcg/dl or	47-65 $\mu\text{mol/L}$
2.	Amilase	4-25 IU/ml	
3.	Billirubin		
-	Direct	0-0.2 mg/gl	0-3 $\mu\text{mol/L}$
-	Indirect	0.2-0.8 mg/dl	30-14 $\mu\text{mol/L}$
-	Total	0.2-1 mg/dl	30-17 $\mu\text{mol/L}$
4.	CO <sub>2</sub>	20-30 mEq/L	24-30 mMol/L
5.	pCO <sub>2</sub>	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 $\mu\text{mol/L}$
9.	Random blood sugar	70-110 mg/dl	3-10 $\mu\text{mol/L}$
10.	Iron	50-150 mcg/dl	9.0-26.9 $\mu\text{mol/L}$
11.	Lactic dehydrogenase	70-210 IU/L	
12.	Magnesium	1.5-2.0 mEq/L	0.8-1.3 mMol/L
13.	pO <sub>2</sub>	75-100 mmHg	
14.	pH	7.35-7.45	
15.	Acid phosphatase		
	Male	0.13-0.63 IU/ml	36-176 nmol s <sup>-1</sup> /L
	Female	0.101-0.65 IU/ml	2.8-156 nmol s <sup>-1</sup> /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 <sup>+</sup> )	3.5-5.0 mEq/L	3.5-5.0 mMol/L
19.	Calcium (Ca <sup>2+</sup> )	8.5-10.5 mg/dl	2.1-2.6 mMol/L
20.	Sodium (Na <sup>+</sup> )	135-145 mEq/L	135-145 mMol/L
21.	Bicarbonate (HCO <sub>3</sub> <sup>-</sup> )	24-38 mEq/L	24-28 mMol/L

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 $\mu\text{mol s}^{-1}/\text{L}$
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 $\times 10^6/\text{mm}^3$	
	Female	4.2-5.4 $\times 10^6/\text{mm}^3$	
	White blood cell (WBC)	4.0-11.0 $\times 10^3/\text{mm}^3$	
	P	60-75%	
	L	20-40%	
	M	4-8%	
	B	0-1%	
	E	1-3%	
	Platelate (Plt)	200-400 $\times 10^3/\text{mm}^3$	
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 (CrCl)	105-150 ml/min/1.73 $\text{m}^2$	
33.	TT <sub>4</sub>	3.0-7.5 mcg/dl	
34.	RT <sub>3</sub> U	25-35%	
35.	FTI	1.3-4.2	

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## NORMAL HEMODYNAMIC VALUES AND DERIVED INDICES

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 <sup>2</sup>
	$CI = \frac{CO}{\text{Body Surface Area}}$		
SV	Stroke Volume	60 - 80	ml/beat
	$SV = \frac{CO}{\text{Heart Rate}}$		
SVI	Stroke Volume Index	30 - 50	ml/beat/m <sup>2</sup>
	$SVI = \frac{SV}{\text{Body Surface Area}}$		
PVR	Pulmonary Vascular Resistance	< 200	dynes.sec.cm <sup>-5</sup>
	$PVR = \frac{MPAP - PCWP}{CO} \times 80$		
TPVR	Total Peripheral Vascular Resistance	900-1400	dynes.sec.cm <sup>-5</sup>
	$TPVR = \frac{MBP - RAP}{CO} \times 80$		
LVSWI	Left Ventricular Stroke Work Index	35-80	gm-m/m <sup>2</sup> /beat
	$LVSWI = (MBP - PCWP) (SVI) (.0136)$		