

Exercises in CLINICAL ACCURACY CHECKING

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This is the fifth set of clinical accuracy exercises to be published in *Hospital Pharmacist*. Readers who have been following the series will have noted that the exercises attempt to address the pharmaceutical and medical issues that arise in different specialties. The two prescriptions in this exercise, dealing with the use of drugs in patients in the intensive care unit (ICU), were used to train pharmacists unfamiliar with ICUs.

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Readers are invited to identify the problems and determine solutions for them. The prescriptions are followed by a discussion of the significant issues.

It must be emphasised that these tests were introduced to assess the performance of checkers in a dispensary situation where time is at a premium. It should also be noted that these prescriptions have passed through the dispensary at Addenbrooke's NHS trust, although the patients' names have been changed to maintain confidentiality. The check list used by candidates is shown in Figure 1.

Figures 2–6 (pp220–1) relate to prescription 1, and Figures 7–12 (pp221–3) relate to prescription 2.

CLINICAL ACCURACY CHECKING TEST

Task

1. You have – **minutes** to review the following prescription charts and identify the problems. You have – **minutes** to document your answers

Total time allowed: – minutes

2. You are only able to make **ONE** intervention per prescription **For each of the prescriptions**, using the answer sheets provided:

- Document the ward and clinical specialty
- List briefly the endorsements you would make to the chart
- List briefly the patient's major medical problem(s) suggested by the drug therapy

6. List briefly the most important pharmaceutical problems you would try to resolve **if you were checking the chart at ward level** (maximum of **SIX** problems)

7. State the **ONE priority intervention** you would make for **EACH of the charts** given that you are **checking the chart in the dispensary**

8. Briefly state the **action** you would take to resolve the priority intervention

9. State the urgency of the **priority** intervention from one of the following:

Urgent = chart must be amended by a doctor or pharmacist before being dispensed

Less urgent = any other action, such as sending an intervention note to the doctor, highlighting the problem to the ward pharmacist, phoning a nurse or doctor for further information.

10. Materials allowed:

Martindale's Extra Pharmacopoeia	BNF
Paediatric formulary	Hospital formulary
Compendium of data sheets and SPCs	Calculator
Trissel's handbook of injectable drugs	Hospital IV monographs
Renal drug handbook	
List of wards — specialty and current ward pharmacist	

Answer sheet

(Candidate name:.....)

Prescription number 1

Review panel:

Ward Clinical specialty

Chart endorsements:

Medical problems:

- | | |
|----|----|
| 1. | 5. |
| 2. | 6. |
| 3. | 7. |
| 4. | 8. |

Pharmaceutical problems:

- | | |
|----|----|
| 1. | 4. |
| 2. | 5. |
| 3. | 6. |

Priority intervention number 1 2 3 4 5 6
(circle the appropriate box)

Suggested action to resolve the priority intervention:

Urgency: Urgent Less urgent
(circle the appropriate box)

Figure 1: Instructions for candidates: state the ward and clinical specialty in order to focus attention on likely problems. For example, if the patient was on a medical ward specialising in renal disease, the pharmacist must be particularly vigilant about renally excreted drugs. The chart endorsements refer to the discharge or to take out (TTO) prescription where one exists or otherwise to the inpatient chart. Please note: candidates are given six minutes to review each prescription, and three minutes to document their answers for each prescription

Prescription Chart					
Surname Smith	Hospital No 217980	Weight	DRUG SENSITIVITIES		
			Doctor must also enter this information on FRONT of case folder must not be administered unless this box has been completed		
First Names Ian	Date of Birth 16.07.71	Sex M	Date 5.5.01	Drug/Substance NKDA	Signature A DOCTOR
Consultant Dr Brown	Ward ICU	Height			

Figure 2: Patient's details on the chart for prescription 1

Regular Prescriptions					Regular Prescriptions					
Month and date					Month and date					
Tick times or enter other times					Tick times or enter other times					
DRUG (APPROVED NAME) Phenobarbitone					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					22					
Additional Instructions										
DRUG (APPROVED NAME) Enoxaparin					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					20					
Additional Instructions										
DRUG (APPROVED NAME) Phenytoin					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					22					
Additional Instructions										
DRUG (APPROVED NAME) Metronidazole					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					20					
Additional Instructions										
DRUG (APPROVED NAME) Sodium Valproate					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					20					
Additional Instructions										
DRUG (APPROVED NAME) Lorazepam					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					20					
Additional Instructions										
DRUG (APPROVED NAME) Vancomycin					6			5.0		
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					20					
Additional Instructions										
DRUG (APPROVED NAME) Meropenem					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					MIN					
Additional Instructions										
DRUG (APPROVED NAME) Ranitidine					6					
Dose					8					
Route					12					
Start Date					14					
Stop Date					18					
Signature					MIN					
Additional Instructions										

Figure 3: Patient's regular drugs (prescription 1). The entry in the 6am row for vancomycin is the plasma concentration of the drug in mg per litre

DRUG (APPROVED NAME) Lorazepam					Date				
Dose	Max Frequency	Route	Start Date	Time					
3mg	PRN	IV	5.5.01						
Signature				Stop Date	Pharm	Dose			
A Doctor						Route			
Additional Instructions / Max. dose in 24 hours						Given by			
DRUG (APPROVED NAME) Atracurium					Date				
Dose	Max Frequency	Route	Start Date	Time					
25mg	PRN	IV	5.5.01						
Signature				Stop Date	Pharm	Dose			
A Doctor						Route			
Additional Instructions / Max. dose in 24 hours						Given by			
DRUG (APPROVED NAME) Paracetamol					Date	7/5			
Dose	Max Frequency	Route	Start Date	Time					
1g	QDS	ng/po/pr	7.5.01	21.00					
Signature				Stop Date	Pharm	Dose	1g pr		
A Doctor						Route	BC		
Additional Instructions / Max. dose in 24 hours						Given by			

Figure 4: Patient's "as required" drugs (prescription 1)

CONTINUOUS INTRAVENOUS INFUSIONS												
PHARM	DATE	DRUG (APPR. NAME)					DOSE	RATE	DILUENT	TOT. VOL	INFUSION RATE	SIGNATURE
	5.5.01	Propofol					2%		Neat	50ml	0-15ml/hour	A Doctor
DATE	5.5.01	6.5.01	6.5.01	7.5.01	7.5.01							
TIME	12	20.40	7.48	22.00	13							
SIGN	BC	BC	BC	BC	BC							
		BC	BC	BC	BC							
PHARM	DATE	DRUG (APPR. NAME)					DOSE	RATE	DILUENT	TOT. VOL	INFUSION RATE	SIGNATURE
	7.5.01	Clonidine					750mcg		5% Dex	50ml	35mcg/hour	A Doctor
DATE	7.5.01											
TIME	18.00											
SIGN	BC											
		BC										

Figure 5: Patient's infusion chart (prescription 1)

Once Only Prescriptions								
Pharm	Date	Drug (approved name)	Dose	Route/other directions	Time to be given	Signature	Given by Initials	Time
	5.5.01	Phenobarbitone	600mg	IV	STAT	A Doctor	AP	11
	5.5.01	Phenytoin	300mg	IV	14.00	A Doctor	BC	14
	5.5.01	Phenytoin	300mg	IV	23.00	A Doctor	BC	23
	7.5.01	Clonidine	280mcg	IV (over 60 minutes)	11.30	A Doctor	BC	11.31

Figure 6: Patient's "once only" drugs (prescription 1)

Prescription Chart								
Surname James		Hospital No 682476		Weight		DRUG SENSITIVITIES		
First Names Bridget		Date of Birth 11.01.67		Sex F		Doctor must also enter this information on FRONT of case folder must not be administered unless this box has been completed		
Consultant Dr Brown		Ward ICU		Height		Date 10.04.01		Signature A DOCTOR
						Drug/Substance Elastoplast		

Figure 7: Patient's details on the chart for prescription 2

Regular Prescriptions										Regular Prescriptions																		
Month and date Tick times or enter other times										Month and date Tick times or enter other times																		
DRUG (APPROVED NAME) Ciprofloxacin						6 8					DRUG (APPROVED NAME) Fluconazole						6 8											
Dose	Route	Start Date	Stop Date			12				Dose						Route	Start Date	Stop Date	12									
200mg	IV	10.4.01	19.4.01			14				75mg						IV	10.4.01	16.4.01	14									
Signature A Doctor				Pharm		18				Signature A Doctor						Pharm		18	X	X	X	X	X	X				
Additional Instructions				MIN						Additional Instructions						MIN												
DRUG (APPROVED NAME) Vancomycin						6 8		20.1	21.2	12.1	27.4	10.9	18.7	DRUG (APPROVED NAME) Enoxaparin						6 8								
Dose	Route	Start Date	Stop Date			12				Dose						Route	Start Date	Stop Date	12									
500mg	IV	10.4.01	19.4.01			14				20mg						s.c	10.4.01	19.4.01	14									
Signature A Doctor				Pharm		18	X	X	X	X	X		X					18										
Additional Instructions				MIN						Additional Instructions						MIN												
DRUG (APPROVED NAME) Folic Acid						6 8								DRUG (APPROVED NAME) Cotrimoxazole						6 8	X		X		X	X		X
Dose	Route	Start Date	Stop Date			12				Dose						Route	Start Date	Stop Date	12									
15mg	IV	10.4.01				14				480mg						po/ng			14									
Signature A Doctor				Pharm		18				Signature A Doctor						Pharm		18										
Additional Instructions				MIN						Additional Instructions						MIN												
DRUG (APPROVED NAME) Vitamin B ₁₂						6 8								DRUG (APPROVED NAME) Omeprazole						6 8	X	X	X	X	X	X		
Dose	Route	Start Date	Stop Date			12				Dose						Route	Start Date	Stop Date	12									
1mg	IV					14				20mg						IV	16.4.01		14									
Signature A Doctor				Pharm		18				Signature A Doctor						Pharm		18	X	X	X	X	X	X				
Additional Instructions				22						Additional Instructions						22												

Figure 8: Patient's regular drugs (prescription 2). The entries in the 6am row for vancomycin are the plasma concentrations of the drug in mg per litre

DRUG (APPROVED NAME) Atacurium				Date	1.8														
Dose	Max Frequency	Route	Start Date	Time	22.00														
50mg	PRN	IV	11.4.01	Dose	0.5mg														
Signature A Doctor				Stop Date															
Additional Instructions / Max. dose in 24 hours				Pharm	AN														
DRUG (APPROVED NAME) Midazolam				Date	1.8														
Dose	Max Frequency	Route	Start Date	Time	22.00														
1-2mg	PRN	IV	13.4.01	Dose	0.5mg														
Signature A Doctor				Stop Date															
Additional Instructions / Max. dose in 24 hours				Pharm	AN														
DRUG (APPROVED NAME) Paracetamol				Date	1.8														
Dose	Max Frequency	Route	Start Date	Time	22.00														
1g		6 po/ng/pr	14.4.01	Dose	0.5mg														
Signature A Doctor				Stop Date															
Additional Instructions / Max. dose in 24 hours				Pharm	AN														

Figure 9: Patient's "as required" drugs (prescription 2)

Once Only Prescriptions							
Pharm	Date	Drug (approved name)	Dose	Route/other directions	Time to be given	Signature	Given by
							Initials	Time
	10.4.01	Mannitol	20%	100ml IV	STAT	A Doctor	BC
	12.4.01	Vancomycin	1g	IV	600	A Doctor	BC
				Pre-post			
	12.4.01	Atracurium	50mg	IV	STAT	A Doctor	BC
	20.4.01	Meropenem	500mg	IV	STAT	A Doctor	BC
	20.4.01	Metronidazole (given in theatre)	500mg	IV	STAT	A Doctor	BC
	20.4.01	Methylprednisolone	1g	IV	STAT	A Doctor	BC
	21.4.01	Methylprednisolone	1g	IV	STAT	A Doctor	BC
	21.4.01	Vitamin K	10mg	IV	STAT	A Doctor	BC
	21.4.01	Atracurium	50mg	IV	STAT	A Doctor	BC

Figure 10: Patient's "once only" drugs (prescription 2)

CONTINUOUS INTRAVENOUS INFUSIONS												
PHARM	DATE	DRUG (APPR. NAME)			DOSE	RATE	DILUENT			TOT. VOL	INFUSION RATE	SIGNATURE
		Propofol			2%		Neat			50ml	0-15ml/hour	A Doctor
DATE	13	13	14									
TIME	5	11	10									
SIGN	DW	CF	AE									
	BC	BC	HR									
PHARM	DATE	DRUG (APPR. NAME)			DOSE	RATE	DILUENT			TOT. VOL	INFUSION RATE	SIGNATURE
		Dopamine			200mg		N/S			50ml	2-5ml/hour	A Doctor
DATE	13	13	14									
TIME	5	22	3									
SIGN	HR	HT	AP									
	IW	CF	JD									
PHARM	DATE	DRUG (APPR. NAME)			DOSE	RATE	DILUENT			TOT. VOL	INFUSION RATE	SIGNATURE
		Frusemide			50mg		N/S			50ml	2ml/hour	A Doctor
DATE	13	14										
TIME	10	10										
SIGN	CF	FM										
	MJ	BF										
PHARM	DATE	DRUG (APPR. NAME)			DOSE	RATE	DILUENT			TOT. VOL	INFUSION RATE	SIGNATURE
		Acetylcysteine			200mg/ml	neat	50ml				3.4ml/hour	A Doctor
DATE	13	14										
TIME	11	7										
SIGN	AL	HR										
	DS	MH										
						INSULIN: UNITS						
> 20 mMol/l.....15 Units 15-20 mMol/l.....12 Units/HR 10-14.9 mMol .....8 Units/HR 5-9.9 mMol .....4 Units/HF <5 mMol .....1 Units/H						TOTAL VOLUME MLS						
						DATE						
						TIME						
						SIGN						
						DATE						
						TIME						
PHARM	DATE	DR SIGNATURE										
		SIGN										

Figure 11: Patient's infusion chart (prescription 2)

Regular Immunosuppression											
MONTH		AND	DATE								
DRUG (APPROVED NAME)					08.00	.	.	.	.
Prednisolone					Dr.	AP	AP	AP	AP		
Dose unit	Route	Start Date	Stop Date		Nurse.	FS	FS	TH	ML		
20mg	po	11.4.01			22.00	.	.	.	.
Signature					Nurse.	CD	HY	WE	MK		
Pharm stock					Nurse.	AS	DF	HT	PL		
DRUG (APPROVED NAME)					08.00	.	.	.	.
Tacrolimus					Dr.	NG	TH	KU	LI		
Dose unit	Route	Start Date	Stop Date		Nurse.	GF	DR	ER	HT		
3mg	po	11.4.01			22.00						
Signature					Nurse.						
Pharm stock											

Figure 12: Patient's immunosuppression chart (prescription 2)

PRESCRIPTION 1

This is a prescription for a critically ill patient with renal impairment, who also had uncontrolled seizures. The main pharmaceutical care issues have to do with the dose and choice of drugs to manage seizures, identification and management of clinically significant drug interactions, dose adjustment in renal impairment and therapeutic drug monitoring.

The main aim of treatment is to control the seizures and preserve vital functions. The patient was previously on phenobarbitone and phenytoin and was apparently non-compliant. Despite being given rectal diazepam the patient continued to have seizures and was therefore put back on phenobarbitone and phenytoin. The administration instructions are included in the intravenous drug monographs for ICU.

Phenobarbitone has a pH of around 9–10 and ideally should not be mixed with other drugs. The intravenous (IV) maintenance dose is the same as the oral dose that the patient had been taking before admission. The oral absorption is over 90 per cent and therefore the IV and oral doses are equivalent. It is not necessary to administer the total daily dose in two divided doses, because the plasma half-life is 50–150 hours. Phenobarbitone is not commonly used, because of the risk of excessive sedation and respiratory failure.

The loading dose of phenytoin in total was equivalent to 10mg per kg. The onset of action is usually 20–30 minutes and serum levels are maintained in the therapeutic range for 24 hours. The loading dose was followed by a maintenance dose of 400mg daily that may be administered as a single daily dose. The plasma half-life varies, depending on the dose range, from seven to 60 hours. The maximum rate of injection is 50mg per minute. The serum phenytoin level should be monitored and the serum albumin and urea levels should be taken into account due to the displacement of free phenytoin. Displacement of free phenytoin occurs if plasma albumin is low, and also if the urea level is high. The increase in the free fraction of phenytoin can lead to toxicity even though the level appears within the reference range for total phenytoin.

Sodium valproate may be given intravenously and the oral and IV dose are equivalent. It causes little respiratory depression and is more effective in focal or complex partial seizures.

Although lorazepam is no more effective than phenobarbitone, phenytoin or diazepam, it may have an adjunctive effect. The dose recommended for status epilepticus is 0.1mg per kg. All four drugs have been advocated for the management of generalised convulsive status epilepticus.¹ Hypotension, a side effect of lorazepam, is a cause for concern and the dose of 2mg twice

daily with additional 3mg doses to be administered as required (*prn*) should be queried, particularly in the context of renal and liver failure and the potential for additional central depressant effect when combined with propofol. A reasonable reduction would be to a dose of 1mg twice daily with 1mg *prn*.

Propofol is used to facilitate ventilation. It is administered by continuous infusion due to its short half-life. Propofol has also

been reported to be effective in the management of seizures. It has the advantage of being rapidly cleared from the body once it is stopped.

The choice of antibiotics for this patient should be queried. Meropenem and metronidazole both cover anaerobes, therefore metronidazole is an unnecessary addition to the prescription. It also has a number of drug interactions which are discussed below.

Enoxaparin should be administered by subcutaneous injection for the prophylaxis of deep vein thrombosis (DVT) or pulmonary embolism (PE), and not intravenously as prescribed. This should be queried.

Clonidine may be prescribed for the management of agitation following withdrawal of sedative drugs and also may be used for sedation in addition to other drugs. The dose is appropriate as doses of up to 1.5 mg have been reported.²

Dose adjustments in renal impairment Table 1 shows recommended dosage adjustments for some of the drugs in prescription 1. The patient has a degree of renal impairment which is suggested by the once daily dose of vancomycin. The pharmacist may suggest dose reductions as appropriate based on the actual creatinine clearance (CrCl) measured by urine collection. It is not appropriate to use the Cockcroft-Gault equation for calculating CrCl, as critically ill patients usually have rapidly changing urea and creatinine levels, particularly in the acute phase of their ICU admission.

Drug interactions Potential drug interactions between anticonvulsants are unpredictable and therapeutic drug monitoring is appropriate for phenytoin, phenobarbitone and sodium valproate. A

Table 1: Dosage advice in renal impairment³ (prescription 1)

Drug	CrCl* 10–25ml/min	CrCl < 10ml/min	CVVHD†	Comments
Vancomycin				Stat dose of 1g with plasma level monitoring. Once the random level falls below 10mg/litre, an additional dose may be given.
Meropenem	500mg <i>tds</i>	500mg <i>bd</i>	500mg <i>bd</i>	
Ranitidine	50mg <i>tds</i>	25–50mg <i>tds</i>	50mg <i>tds</i>	Reports of confusion in renal failure and isolated cases of thrombocytopenia
Lorazepam	Normal dose	Normal dose	Not cleared but metabolite glucuronide is highly dialysable and inactive	
Paracetamol	Normal dose	500–1g <i>tds</i>	Normal dose	

* Creatinine clearance † Continuous veno-venous haemodiafiltration

Note: No dose adjustment is required for those drugs featured in prescription 1 but not included in this table

Table 2: Dosage advice in renal impairment³ (prescription 2)

Drug	CrCl 1 0–25ml/min	CrCl < 10ml/min	CVVHD	Comments
Vancomycin				Stat dose of 500mg with plasma level monitoring. Once the single timed level falls below 10mg/litre, an additional dose may be given
Meropenem	500mg <i>tds</i>	500mg <i>bd</i>	500mg <i>bd</i>	Although the manufacturer recommends that a dose reduction is necessary, a dose reduction is not advised unless the patient has co-existing liver and bowel pathology
Ciprofloxacin	Normal	Normal	Normal	
Midazolam	Normal dose	Half normal dose	Normal dose	
Cotrimoxazole	Prophylactic dose	Prophylactic dose	Prophylactic dose	
Fluconazole	Normal dose	Half normal dose	Normal dose	
Paracetamol	Normal dose	500mg–1g <i>tds</i>	Normal dose	

Note: No dose adjustment is required for those drugs featured in prescription 2 but not included in this table

would be 100mg daily and the route of administration could be a choice between the oral or nasogastric (NG) route since the immunosuppression medication is already being administered via the NG route. The oral bioavailability of fluconazole is greater than 90 per cent and the IV to NG doses are equivalent.

Co-trimoxazole is first line prophylaxis against PCP. The patient does not have any recorded drug sensitivities and co-trimoxazole is an appropriate choice. The dose frequency is reduced to three times weekly administration to reduce the risk of adverse reactions associated with sulphonamides. Increased doses show increased toxicity but no increased benefit in terms of reduced incidence of PCP. The dose most commonly

review of the anticonvulsant therapy may be appropriate once the patient is stabilised and discharged from ICU.

Metronidazole inhibits the cytochrome CYP2C9 enzyme and hence the metabolism of phenytoin. In addition, phenobarbitone induces the metabolism of metronidazole. Anecdotal reports exist of reduced efficacy with phenobarbitone. This is really academic, since metronidazole is superfluous to the regimen.

A competent candidate would be expected to:

- recognise that critically ill patients are likely to have renal impairment and to check for any required dose adjustments
- identify the potential for drug interactions and advise on plasma level monitoring
- highlight the overlap in antibiotic spectrum between meropenem and metronidazole and advise that metronidazole be discontinued
- be aware of the risk of hypotension with lorazepam, propofol and clonidine, particularly with the high dose prescribed and suggest that a dose reduction may be appropriate
- point out the incorrect route of administration of enoxaparin and advise giving it subcutaneously

— PRESCRIPTION 2

The prescription is for a liver transplant patient admitted to ICU for routine post-operative monitoring. The pharmaceutical care issues are again concerned with renal impairment and consequent dose adjustments, as well as the identification and management of drug interactions. It is also necessary to ensure that the appropriate doses and dose frequencies of antifungals, *Pneumocystis carinii* pneumonia (PCP) prophylaxis and stress ulcer prophylaxis are used. As in the previous prescription, the patient is renally impaired. Table 2 shows recommended dosage adjustments for some of the drugs in prescription 2.

Hydroxocobalamin and folic acid are prescribed post-operatively because of the use, in the theatre, of nitrous oxide. Nitrous oxide inactivates vitamin B₁₂ and hydroxocobalamin may be continued as prophylaxis if the patient is having renal replacement therapy with continuous veno-venous haemodiafiltration (CVVHD).

Antifungal prophylaxis is prescribed in patients with acute liver failure because of the increased risk of fungal infection. The 75mg dose of fluconazole is unusual and should be queried. A normal dose

used at Addenbrooke's Hospital is 480mg three times a week on Monday, Wednesday and Friday.

The omeprazole is used as an alternative to either sucralfate or ranitidine for stress ulcer prophylaxis.⁴ The indication for omeprazole is the management of gastrointestinal problems existing before transplantation, including varices. Since the patient is now receiving corticosteroids, it is appropriate to continue. The dose frequency is unusual and twice daily administration is not necessary. Although the plasma half-life is only about one hour, the pharmacological action is protracted and once daily administration is appropriate for most patients.

Drug interactions There is a clinically significant interaction between fluconazole and tacrolimus. Fluconazole is an inhibitor of the cytochrome P4503A4 enzyme and tacrolimus is metabolised by this enzyme system. Thus, the potential for increased tacrolimus levels exists. Tacrolimus plasma levels are routinely monitored three times a week. Any unacceptable rise in the tacrolimus level would be identified and a dose adjustment made.

A competent candidate would be expected to:

- recognise that critically ill patients are likely to have renal impairment and to check for any dose adjustments that are required
- identify the potential for drug interactions and advise on plasma level monitoring
- identify and advise on the inappropriate dose and dose frequency for co-trimoxazole, fluconazole and omeprazole

N.B. Solutions to these exercises are shown on the next page.

REFERENCES

1. Treiman D, Meyers P, Walton N, Collins J, Colling C, Rowan J et al. A comparison of four treatments for generalised convulsive status epilepticus. *N Engl J Med* 1998;339:792–8.
2. Bohrer H, Bach A, Layer M, Werning P. Clonidine as a sedative adjunct in intensive care. *Intens Care Med* 1990;16:265–6.
3. Bunn R, Ashley C. *The renal drug handbook*. Oxford: Radcliffe Medical Press; 1999.
4. Messori A, Trippoli S, Vaiani M, Gorini M, Corrado A. Bleeding and pneumonia in intensive care patients given ranitidine and sucralfate for prevention of stress ulcer: meta-analysis of randomised controlled trials *BMJ* 2000;321:1103–6.

Answer sheet (answers are shown in magenta)

Candidate name:.....

Prescription number 1
 Ward: Intensive Care Unit Clinical specialty: Critical care

Chart endorsements:

1. CD for phenobarbitone
2. Maximum rate of injection for undiluted phenytoin 50mg per minute
3. Maximum rate of infusion for vancomycin is 10mg per minute
4. Atracurium — discontinue when patient is not being ventilated
5. Paracetamol — maximum 4g in 24 hours

Medical problems:

- | | |
|-----------------------------|---------------------------|
| 1. Uncontrolled seizures | 5. DVT/PE prophylaxis |
| 2. Stress ulcer prophylaxis | 6. Pain |
| 3. Sepsis | 7. Mechanical ventilation |
| 4. Renal impairment | |

Pharmaceutical problems:

1. Dose of intravenous lorazepam
2. Route of enoxaparin
3. Identification and management of drug interactions
4. Dose adjustment in renal impairment
5. Therapeutic drug monitoring
6. Choice of antibiotics and drugs for management of seizures

Priority intervention number Number 1, but candidate would be expected to mention 2, 3 and 4

Suggested action to resolve the priority intervention:

1. Contact prescriber and suggest reducing the dose of lorazepam as the patient is hypotensive but free from fitting. Suggest 1mg twice daily with 1mg as required.
2. Ask prescriber to amend prescription for route of administration for enoxaparin
3. Identify the interaction between metronidazole and phenytoin (review of the need for metronidazole required). Also additive hypotensive and sedative effect of lorazepam, propofol and phenobarbitone
4. Suggest dose reduction for meropenem and ranitidine

Urgency: Less urgent

Figure 13: Solution to prescription 1

Answer sheet (answers are shown in magenta)

Candidate name:.....

Prescription number 2
 Ward: Intensive care unit Clinical specialty: Critical care

Chart endorsements:

1. Vancomycin — maximum infusion rate is 10mg per minute
2. Paracetamol — maximum dose 4g in 24 hours
3. Atracurium to be discontinued when patient is no longer being ventilated

Medical problems:

- | | |
|-------------------------------|-----------------------|
| 1. Liver transplant recipient | 5. DVT/PE prophylaxis |
| 2. Immunosuppressed | |
| 3. Renal impairment | |
| 4. Stress ulcer prophylaxis | |

Pharmaceutical problems:

1. Dose and frequency of prophylactic drugs
2. Dose adjustment in renal impairment
3. Identification and management of drug interactions

Priority intervention number Number 1, but candidate would be expected to mention 2 and 3

Suggested action to resolve the priority intervention:

1. Advise prescriber verbally or in writing on the appropriate dose and dose frequency of fluconazole, cotrimoxazole and omeprazole
2. Advise dose adjustment for meropenem
3. Ensure therapeutic drug monitoring for tacrolimus

Urgency: Less urgent

Figure : Solution to prescription 2