Pharmaco Logical

The Newsletter of the Rational Use of Medicines Directorate
Ministry of Health, Sultanate of Oman

Volume 4 Number 2, October 2008

This edition appears slightly later than normal due to a number of unavoidable factors. From now on we plan to post each new edition on the Oman rational use of medicines news group which is in Yahoo groups as **rduoman.**

YAHOO! HEALTH Groups

http://health.groups.yahoo.com/group/rduoman

Membership of the group has been small (quality over quantity) and contributions sporadic but thanks to our RUM friend and colleague Dr Hassan Al Lawati the group has recently seen a potent injection of new rational use issues. We are now up to 21 members and the content is improving all the time. Like all groups you will probably get as much out of it as you put in. So the more contributions we can get the better.

Posting this newsletter on the above site seems to be a rational approach to the ongoing problems of distribution. Theoretically, more of you will have easier and more rapid access to a very useful and interesting publication.

News

The Directorate has been active on several fronts with workshops in North & South Batinah, North Sharqiya, Dhofar governorate and Muscat. The topics have ranged from rational use of medicines to rational prescribing, research methodology and public education.

Contributors to this issue

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Edited by Dr Brian Gunn

Pictures are taken from two recent workshops

Coming Soon!

ONF - 2009

The new edition of the Oman National Formulary (ONF) is in

its final stages of completion and will soon be ready for printing. The first edition appeared in June 2003 so there have been quite a few changes in the interim period. There are changes in some medications; additions and deletions. Monographs have been reviewed and updated to take account of the ever changing protocols. There are several additional appendixes full of useful information and the indexing has been improved to make searching easier. The indication of medicine cost has been completely revised. Prices for individual drugs have been removed and instead an indicative price range for the medicines has been introduced. This has saved some space and will allow easier comparisons. The binding of the booklet is different for this edition which will be spiral bound. This, together with a more user - friendly pocket size will make quick reference much easier.

Electronic format

With the cooperation of IT department it is hoped that this edition will definitely be available in electronic format. Therefore it should be accessible from all computerised facilities. The information in the ONF must be available to as many individuals as possible and in a convenient format.

More Frequent Updating?

The national survey that was conducted by DRUM in 2006 indicated that many individuals would like more frequent updates to the ONF. Unfortunately our current resources do not allow this. However, as changes to the list of drugs are much less frequent than with other health systems and their national formularies (e.g. BNF) it is not necessary to update our formulary more often than every four years. Such questions were raised on the international e-drug newsgroup forum and the bulk of expert opinion agreed.

Final Appearance?

We have considered a few different options. We hope the final version will appeal to most people and we also hope users find it more 'user-friendly' and portable.

DRUM Roll

Workshops Conducted by DRUM Since March Newsletter

- Newly appointed MOGPs
- N & S Batinah
- N& S Sharqiyah
- Al Wusta
- Medical Interns from SQUCoM and OMC

Coming Soon

Nurse Prescribers' Workshop

Publications

ONF 2009 In the final stages of production

Operational Research (current and ongoing)

1. Household Survey on Use and Storage of Medicines
2. Patients Refusal of Medicine from the Pharmacy
3. Diabetes Risk with Atypical Antipsychotic Medication
4. Consultation & Dispensing Time in Primary Health Care (PHC) Facilities
5. Prescribing Patterns of Nurses in the Absence of a Physician in PHC

Working group at Ibra Workshop

Clostridium difficile

by Dr Brian C Gunn

Clostridium difficile (*C. diff*) is a gram-positive, anaerobic spore-forming bacillus which is found naturally in the gut of about 3% of adults and 66% of infants.

Photo electron micrograph of Clostridium difficile showing drumstick features

Under normal circumstances it causes no problems and its growth is held in check by interaction and competition with the other gut flora. However, if conditions are right the bacterium can grow and it can cause a spectrum of disease from asymptomatic to mild through to severe diarrhoea or to a fulminant inflammation and ulceration of the bowel – pseudomembranous colitis. This latter condition can be life threatening. The main reason for overgrowth with C. diff is due to the overuse of broad spectrum antibiotics usually in a hospital setting. The broad spectrum antibiotics disturb the natural balance of the gut flora. The bacterium produces two exotoxins A & B which can be identified in stool samples. Unfortunately the test returns a high number of false negatives. One particular dangerous genetic variant of *C difficile* is type 027 which produces much more toxin than other forms

The elderly and severely ill patients are at most risk with 80% of reported cases in the over 65 age group. Patients with impaired immune status or those who have had repeated enemas or gut surgery are also likely candidates for the condition.

C. difficile is not considered to be a hospital "superbug"[1] like MRSA[2] or VRSA[3] as it can be treated relatively easily. However, patients with diarrhoea who have *C diff* can spread it rapidly throughout the environment and to other patients. Recently some resistant hypervirulent strains have emerged.

The bacterium forms spores which allows it to survive in the environment for long periods until conditions are favourable for its growth. The spores have been found on floors, especially around toilets and also airborne.

Treatment of *C difficile* – associated disease (CDAD) is by vancomycin or metronidazole with recent clinical evidence in favour of the former especially in combination with a probiotic[4] *Saccharomyces boulardii*. The mean duration of treatment has been shown to be much shorter with vancomycin. Smaller trials with fusidic acid and bacitracin have also shown some efficacy. Non antibiotic treatments have been tried with some success e.g. human gamma globulin, immunotherapy with an *anti-C difficile* whey protein concentrate, and a *C difficile* form of toxoid vaccine. Also, probiotic faecal enemas have been used. In some severe cases surgical intervention may be required with resection of the inflamed bowel.

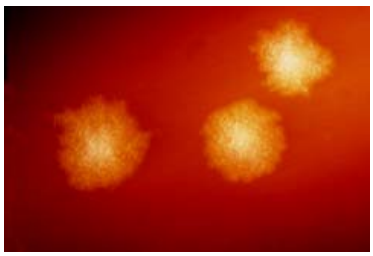
Antibiotics which may be the causative agents include: clindamycin and more commonly 2nd, 3rd and higher generation cephalosporins. It has been speculated that CDAD is a "3-Hits" disease. First exposure to an antibiotic causes resistant *C diff* strains to emerge, second causes these strains to develop and establish. The third hit depends on various combinations of host and organism factors leading to either acquisition of the disease or

[1] This term has been coined by the popular press and other media.
[2] MRSA = methicillin resistant Staphylococcus aureus
[3] VRSA = vancomycin resistant Staphylococcus aureus

[4] *'Live microorganisms which when administered in adequate amounts confer a health benefit on the host'- WHO/FAO definition*

resulting in a patient who is an asymptomatic carrier.

A multi-pronged approach to control of the infections in a hospital setting consists of a sound protocol for antibiotic use, prevention of cross-infection by maintaining high standards of hygiene and rigorous hand washing, excellent infection control plus ongoing surveillance.



***C difficile* on a blood agar plate**

Further reading

- http://www.medscape.com/viewarticle/570064
- http://en.wikipedia.org/wiki/Clostridium_difficile

Patient Stockpiling & Returned Medicines

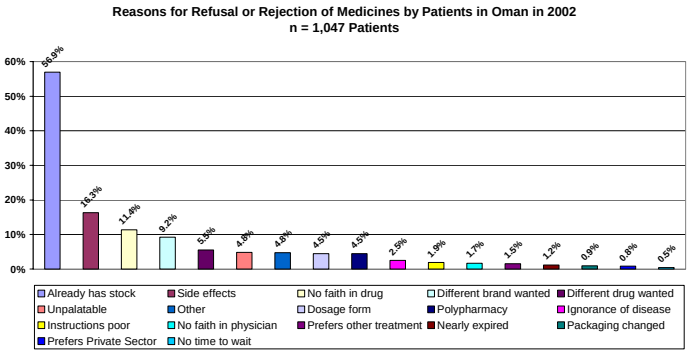
by Dr Brian Gunn

Throughout every health system in the world there are many

examples of massive wastage of medicines due to non-usage of medicines or patient stockpiling. Such phenomena are important to study because wastage has a huge economic impact and is an indication that the overall health system is failing in a major way.

In the UK it has been estimated that some 100 million UK pounds are wasted on unused medicines. The wastage from Scotland alone could pay for an extra 3,500 heart by-pass operations.[5]

If a patient has gone through the health system, and perhaps undergone many different tests and procedures and finally received medicine treatment, what possible reasons could there be for non-usage of the treatment?



In 2003 the Directorate of Rational Use of Medicines (DRDU in those days) conducted its own research to establish what was happening in the Oman health system and why prescribed medicines were being refused by patients. On visiting several health facilities it was observed that on occasions patients were refusing to take the medicines that had been prescribed. This phenomenon was also indicated on the prescriptions. In order to assess the extent of the problem a special pro-forma was prepared in Arabic and English. The survey forms contained 17 potential reasons for refusal of medicine which were to be filled by asking the patient. One survey question was a 'catch all' question which allowed for any other reason that had not been covered. With the excellent help of assistant pharmacists we were able to gather results from all over the Sultanate. The results have previously been discussed in an earlier edition of this newsletter.[6]

The most predominant reason for refusal of medicine on that occasion was that the patients claimed to already have a stock at home.

If this is true then the health system has failed these particular patients

The study as described only looked at a small sub-set of patients i.e. only those who are

5 http://news.bbc.co.uk/2/hi/uk_news/scotland/7674308.stm

6 Pharmaco Logical V1 No 1, Feb 2005

attending a clinic and are actively refusing the prescribed medicine. There may be many patients who accept medication but dispose of it at a later time. Some may keep it for a relative or friend or for personal use at a later time.

One interesting area of research is about to be conducted throughout the country by DRUM. The study will examine medicines in the home together with a survey of the patients themselves.

The overall solution must be in the proper and comprehensive education of the public on rational use and storage of medicines. Patients should also be encouraged to return unused, or unwanted medicines to the pharmacy or some other designated receiving area. Many countries have carried out so called DUMP campaigns (dispose of unwanted medicines properly). The results of these studies will be used to target certain patient groups or certain regions for the ongoing public education campaign.

Although suggestions have been made that returned drugs could be recycled this is a very controversial issue and is unlikely to happen.

Recycling

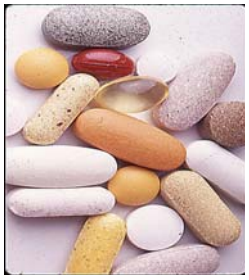
Many times recycling schemes for unused or returned medicines have been proposed. All of them have been rejected. The major reason for rejection is that it can never be assured that medicines have been stored or treated properly once they have left the pharmacy or health facility.

There are so many instances where the medicines could have been stored inappropriately.
Patients have been known to store drugs in their vehicles during hot weather, close to radiators or heaters or in damp locations.
Also, sometimes the medicine might have been removed from its original packaging or transferred to another container. Perhaps labels, vital instructions or expiry date information might be lost or be illegible.

It seems the best solution would be in tackling the source of the problem by having skilled pharmacists trained in medicine review and rational use. A fraction of the amount wasted could be better spent in putting more resources into such a task force.

Fixed Dose Combinations

by
Ph.Manal Al-ansari



Fixed Dose Combinations (FDCs) are combinations of two or more active drugs formulated as a single formulation. If combined rationally, they provide the advantages of combination therapy while reducing the number of prescriptions and the associated costs. If combined irrationally, they may have adverse effects or improper dosing, and also lead to increased cost.

1. Rationale for Combination Therapy

All drugs have unwanted side effects in addition to the desired therapeutic effect. The idea of combining two or more drugs with complimentary modes of action is to produce additively, the desired therapeutic effect but not the side effects.
For ***example***, consider the combination
co-trimoxazole (trimethoprim + sulfamethoxazole).
The two FDC drugs in this, block two consecutive steps in biosynthesis of essential nucleic acids and proteins in bacteria, thus killing bacteria more effectively than each drug could have done independently.

2 Advantages of Fixed Dose Combinations

- Reduced administration costs stem from simplified packaging,

fewer prescriptions, and shorter dispensing time and cost.

- Reducing the number of pills to be taken diminishes the complexity of the regimen, so that improved patient adherence is expected with FDCs.
- Improving compliance in the treatment of chronic infectious disease, where partial adherence can lead to the development of drug-resistant strains, treatment failure and a threat to public health. An example of this is the treatment of TB and HIV.
- The side effects of one medicine can be reduced by combining it with another medicine in a FDC. (e.g., carbidopa prevents enzymatic breakdown in the periphery and reduces the side effects of levodopa).
- The efficacy of one medicine can be synergistically increased, by combining it with another for example the combination of estrogen and progesterone in oral contraceptives; the combination of sulfamethoxazole and trimethoprim as bactericidal; pyrimethamine and sulfadoxine for the treatment and prophylaxis of falciparum malaria.

3. Disadvantages of Fixed Dose Combinations:

- Flexibility of dosage (titration of dose of medicine/s to suit individual patients) is not possible with fixed combinations e.g. FDC of 10 mg Atorvastatin + 5mg Amlodipine
- Increase the price of the medication if unnecessary drugs are included for example, FDC of Ibuprofen + Paracetamol + Caffeine.
- One of the drugs in the combination may be superfluous or wasteful for example, the Combination of vitamins with iron.
- Most combinations do not have a sound rationale for example, the FDC of more than one analgesic.
- Increase the incidence of adverse effects for example, the FDC of more than one NSAID.
- There is always a chance that individual medicines may not be present in adequate amounts for example, multivitamins.
- Incompatible pharmacodynamics, e.g., FDC of antihistaminic with an antidiarrhoeal is dangerous. The antihistaminic action may mask other symptoms and make accurate diagnosis and treatment difficult.
- The physician's and the pharmacist's ignorance of contents and composition of formulation can cause serious problems.
- It is difficult to identify/pinpoint which medicine in the FDC has caused an adverse effect.

The most widely prescribed FDCs that do not have a rational basis are mostly analgesics, multivitamin combinations, and cold and cough mixtures!!

4. Rational Combinations Recommended by WHO

The WHO through its Essential Medicines List recommends only the following FDCs:

- Amoxicillin + Clavulanic acid
- Artemether + Lumefantrine
- Benzoic acid + Salicylic acid (external use)
- Carbidopa + Levodopa
- Ethinylestradiol + Levonorgestrel
- Ethinylestradiol + Norethisterone
- Ferrous salt + Folic acid
- Imipenem + Cilastatin
- Iopinavir + Ritonavir
- Isoniazid + Rifampicin
- Isoniazid + Ethambutol
- Isoniazid + Thioacetazone
- Lidocaine + Epinephrine
- Neomycin + Bacitracin (external use)
- Rifampicin + Isoniazid + Pyrazinamide
- Rifampicin + Isoniazid + Pyrazinamide + Ethambutol
- Sulfadoxine + Pyrimethamine
- Sulfamethoxazole + Trimethoprim

Some Examples of Irrational FDCs available in today's market

- Combination of antibacterials and antiamoebics.
- Multivitamin preparations.

- Painkillers often combined with caffeine.
- Tonics containing incorrect proportions of vitamins and minerals.
- Cough suppressants and expectorants in the same cough mixtures.

Coffee or Tea Anyone?

Prescribing Nescafé?

No, on this occasion we are not recommending that the famous coffee brand should be prescribed for treatment. Rather, we would like everyone to consider a very useful acronym for rational prescribing.

When prescribing or dispensing any drug consider:

Is it?

N	Necessary
E	Efficacious
S	Safe
C	Cost effective
A	Allergenic
F	Followed up
E	Explained (to patient)

Tea Could Help Combat Diabetes……[7]

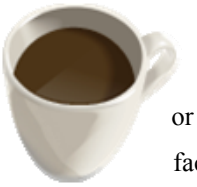
Tea (chai) is a very popular drink here as in most of the world. In fact much of the working and social day revolves around the consumption of tea. Some cultures, such as Japan, even have elaborate ceremonies dedicated to the drinking of tea. Over the centuries tea has been drunk as a mild stimulant or pick-me-up and it generally gives people a feeling of well-being. There have been many claims about the medicinal properties of tea and its many active ingredients. Now scientists at the university of Dundee in Scotland have found that the drinking of black tea could help to combat type 2 diabetes. Two particular constituents of the tea are known as theaflavins and thearubigins. These compounds mimic the action of insulin in the body on certain proteins called "foxOs". FoxOs have been shown to be involved in many vital processes involving diet and health. Much more research needs to be conducted and the lead researcher (Dr Rena) stressed that it was too early for people to start drinking gallons of black tea in order to cure them of their diabetes. She also indicated that patients should continue to take their prescribed medication as directed.

……But Milk in Tea May Block Other Potential Health Benefits[8]

Another benefit of drinking tea that has been claimed is in protecting against cardiovascular disease. A small study in Germany found that drinking black tea significantly improved the abilities of arteries to relax and expand to keep blood pressure healthy. However, the researchers also found that proteins in milk, called caseins, blocked this effect. The responsible molecules in tea are the catechins which produce nitric oxide (an endogenous vaso-dilator).

Relatively few people enjoy drinking tea without milk. In this country and most of the Indian subcontinent, the tea that is drunk is sometimes up to 50% milk!

The German study is probably too small to reach any meaningful conclusions. It is also probably wrong to consider only one or two dietary factors in chronic diseases.



People should continue to enjoy drinks like tea in the way they prefer but also be aware of their overall dietary habits. A healthy diet and a reasonable exercise regime are still the best way to maintain health.

[7] http://news.bbc.co.uk/1/hi/health/7617294.stm

[8] http://news.bbc.co.uk/1/hi/health/6241139.stm

Drug Interactions – Part IV.

Useful or Non Harmful Interactions

by Dr Brian Gunn

If you check in the appendixes of the BNF or ONF you will find many drug-drug and other interactions. In most reference works interactions are listed by generic drug name or therapeutic group name and then specific examples are listed for each interacting drug or therapeutic group. The lists usually contain some indication of the severity of the result of an interaction so that you can quickly gauge those that are particularly serious. However, not all drug interactions are necessarily harmful and in some cases the interaction can be highly beneficial or even life-saving.

I. Pharmacodynamic interactions

a) **Opiates and naloxone**

A typical pharmacodynamic interaction occurs between the drug naloxone and any opiate. The drugs compete for the same endogenous receptors in a competitive manner. In the case of naloxone it has a high affinity for the opiate receptor but negligible efficacy. It, thus, can reverse the effect of an overdosage of opiate. The result is a very dramatic reversal of potentially fatal respiratory depression.

b) **Cholinergic drugs and atropine**

Atropine antagonises the muscarinic actions of acetyl choline or other cholinergic drugs. Therefore atropine can be a useful antidote for organophosphate poisoning. It has many other uses in therapeutics.

II. Pharmacokinetic Interactions

1. **Absorption**

Ascorbic acid is used to enhance the absorption of iron salts

2. **Distribution and**
3. **Metabolism**

Carbidopa is combined with levodopa to allow it to access the CNS. The carbidopa is an inhibitor of dopa decarboxylase which would inactivate the levodopa in the peripheral circulation.

Adrenaline is used in lidocaine injections to prolong the latter's local anaesthetic effect.

Procaine and benzathine prolong the activity of benzylpenicillin by only allowing regular small quantities to leach out from muscle to plasma

4. **Excretion**

Probenecid has been combined with certain β-lactam antibiotics to prevent their active excretion by the renal tubular cells. Probenecid is a competitive inhibitor of the transporter protein.

Commonly Prescribed Interactions

There are many occasions in medicine where drugs are given together even although there is a known drug – drug interaction. It often occurs in patients with chronic medical conditions who are perhaps stabilised on one of the drugs.

Examples include:

Low dose aspirin and warfarin.

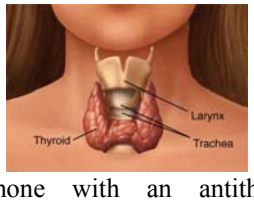
The patient is given warfarin but has been on regular daily low dose aspirin. There is no reason to stop the aspirin provided the patients INR is monitored regularly and warfarin dose adjusted appropriately.

Aspirin and methotrexate

A serious interaction is known between these two drugs but sometimes a rheumatoid arthritis patient can have concomitant aspirin and methotrexate. The dose of methotrexate needs to be reduced and monitored appropriately.

Carbimazole and thyroxine

This combination seems to be totally irrational because the patient is receiving a thyroid



hormone with an antithyroid drug. The reason is, there is a need to reduce the hyperactivity

of the thyroid gland and to render the patient euthyroid[9] without going into hypothyroidism.

Sometimes a drug may be added to counteract a side effect of another medication. In cancer chemotherapy an interacting drug might be administered to reduce the overall toxicity of the antitumor drug.

Examples.

Haloperidol or chlorpromazine and antimuscarinic drugs.

Drugs such as procyclidine, benzhexol and orphenadrine are antimuscarinics co-prescribed with antipsychotic medications to counteract any extrapyramidal (Parkinson's like) side effects.

Cyclophosphamide or ifosfamide and Mesna.

In cancer chemotherapy Mesna reacts specifically with the metabolite, acrolein, in the urinary tract, preventing toxicity. Mesna is used routinely (preferably by mouth) in patients receiving ifosfamide, and in patients receiving cyclophosphamide by the intravenous route at a high dose (e.g. more than 2 g) or in those who experienced urothelial toxicity when given cyclophosphamide previously.

5 - Fluorouracil

Intentional drug interactions may provide the rationale for certain drug combinations — for example, leucovorin enhances the binding of fluorouracil.

[9] Euthyroid = normal thyroid activity

Monoclonal Antibody Therapy

Since about the mid 1990's a whole new series of drugs started to appear on the market. These were the monoclonal antibodies or mAbs. These drugs have held out a great promise to tackle a number of diseases including cancers, viral infections, asthma, and inflammatory diseases particularly autoimmune diseases, including multiple sclerosis (MS).

Initial results with mAbs were disappointing because they were almost all derived from mice (murine type) and as a result they had a very short half – life in vivo due to immune complex formation. Advances in recombinant DNA technology has allowed for the production of chimeric (a fusion of mouse and human antibody producing genes) and humanised monoclonal antibodies. Although the early humanised mAbs had lower affinity for binding sites they were much less antigenic and affinity has been improved over the years by inducing mutations in the critical binding regions of the antibodies.

Currently, twenty-one FDA-approved therapies exist, and hundreds of therapies are undergoing clinical trials. Most are concerned with immunological and oncological targets. The above table demonstrates the availability of these drugs and the spectrum of diseases they can be used to treat.

Antibody	Type	Target	Approved treatment(s)
Abciximab	chimeric	inhibition of glycoprotein IIb/IIIa	Cardiovascular disease
Adalimumab	human	inhibition of TNF-a signalling	Inflammatory diseases
Alemtuzumab	humanized	CD52	Chronic lymphocytic leukemia
Basiliximab	chimeric	IL-2 receptor a	Transplant rejection
Bevacizumab	humanized	vascular endothelial growth factor	Colorectal cancer
Cetuximab	chimeric	epidermal growth factor receptor	Colorectal cancer
Daclizumab	humanized	IL-2 receptor a	Transplant rejection
Eculizumab	humanized	complement system protein C5	Inflammatory diseases including paroxysmal nocturnal hemoglobinuria
Efalizumab	humanized	CD11a	Inflammatory diseases (psoriasis)
Ibritumomab tiuxetan	murine	CD20	Non-Hodgkin lymphoma
Infliximab	chimeric	inhibition of TNF-a signalling	Inflammatory diseases
Muromonab-CD3	murine	T cell CD3 Receptor	Transplant rejection
Natalizumab	humanized	T cell VLA4 receptor	Inflammatory diseases (MS therapy)
Omalizumab	humanized	immunoglobulin E (IgE)	Inflammatory diseases (asthma therapy)
Palivizumab	humanized	an epitope of the F protein of RSV	Viral infection (Respiratory Syncytial Virus (RSV)
Panitumumab	human	epidermal growth factor receptor	Colorectal cancer
Ranibizumab	humanized	vascular endothelial growth factor	Macular degeneration
Gemtuzumab ozogamicin	humanized	CD33	Acute myelogenous leukemia (with calicheamicin)
Rituximab	chimeric	CD20	Non-Hodgkin lymphoma
Tositumomab	murine	CD20	Non-Hodgkin lymphoma
Trastuzumab	humanized	ErbB2	Breast cancer

WHAT HAPPENS IF A DISPENSING MISTAKE IS MADE?

- Sometimes a dispenser makes a mistake and gives incorrect information. This may lead to a patient suffering and can end in prosecution. Therefore,
- great care is needed.
- If a dispensing mistake is made:
  - Don't keep it secret
  - Inform the prescriber and patient
- Learn from the mistake, so that it is not made again
  - Have good up-to-date reference books and use them
  - Look at ways to change the dispensing practice or more training

CORE INTERVENTIONS TO PROMOTE RATIONAL USE OF MEDICINES

- Medicines policy
- Clinical/Therapeutic guidelines
- Essential medicines list
- Drug and therapeutic committees
- Continuing in-service medical education
- Supervision, audit and feedback
- Independent information on medicines
- Public education about medicines
- Appropriate and enforced regulations
- Sufficient government expenditure to ensure availability of medicines and staff

by
Dr Ahmed Abdo-Rabbo & Ph Manal Al-Ansari

COMMON DISPENSING ERRORS

1. Misreading the prescription, e.g. the medicine's name, dose of the medicine
2. Errors during verbal communication, e.g. wrong listening or understanding
3. Picking errors, e.g. picking wrong medicine, strength, or form
4. Expiry error, e.g. dispensing expired medicine
5. Counting error, e.g. counting wrong quantity of medicine
6. Labelling error, e.g. writing or putting the wrong label
7. Packing error, e.g. putting somebody else's medicine packing in the parcel
8. Delivery error, e.g. delivering the parcel to similar patient name

PRESCRIPTION WRITING FOR THE ELDERLY

- Involve the patient in the discussion
- Obtain a complete drug history
- Avoid prescribing before diagnosis
- Review the medications used before prescribing a new one
- Prescribe drugs which you are familiar with their pharmacology
- Avoid unnecessary medication
- Start therapy at a lowest dose & adjust dose on basis of tolerability and response
- Attempt to maximize dose before switching or adding another drug
- Whenever possible prescribe a drug which is given once or twice daily
- Explain clearly & write full instructions
- Attempt to use one drug to treat two or more conditions
- Avoid combination products
- Avoid using drugs from the same class with similar actions
- Try to prescribe matching quantities

Answer these questions?

The answer starts with the letter of the alphabet indicated.

A. The chemical compound of Vitamin C?

B. Four masses of grey matter located deep in the cerebral hemispheres?

C. Arteries arise from aorta, and are the principle blood supply to the head and neck?

D. An oral iron-chelating agent?

E. Fraction of blood pumped out of a ventricle with each heart beat?

F. An opioid analgesic?

G. International Non-proprietary name for a drug?

H. Name of the major histocompatibility complex (MHC) in humans?

I. Any adverse mental or physical condition induced in a patient by effects of treatment by a physician or surgeon?

J. Occurs when plasma bilirubin > 35 micromole/L?

K. Deposition of bilirubin in central nervous tissue

L. A conductor attached to an electrocardiograph (ECG)?

M. An oral antihyperglycaemic drug used in treatment of diabetes mellitus type 2 combined with obesity?

N. A crystalline, white, solid hydrocarbon, primary ingredient of mothballs?

O. Hormone released by the human posterior pituitary gland and facilitates birth and breastfeeding?

P. Severe infection of the colon, due to overgrowth of Clostridium difficile following antibiotics use?

Q. Used parenterally in the treatment of malaria caused by Plasmodium falciparum?

R. Vitamin B2?

S. Disaccharide made up of glucose and fructose?

T. Type of dry powder inhalers?

U. A chemical which might be raised in blood by the use of diuretics?

V. The 8th cranial nerve?

W. Contagious type of skin viral infection caused by the human papilloma virus (HPV)?

X. Tissue or organs from an individual of one species transplanted into or grafted onto another species?

Y. Gram negative bacteria, causative agent for plague?

Z. A bisphosphonate can be used to treat hypercalcaemia of malignancy?

Letter	Answer
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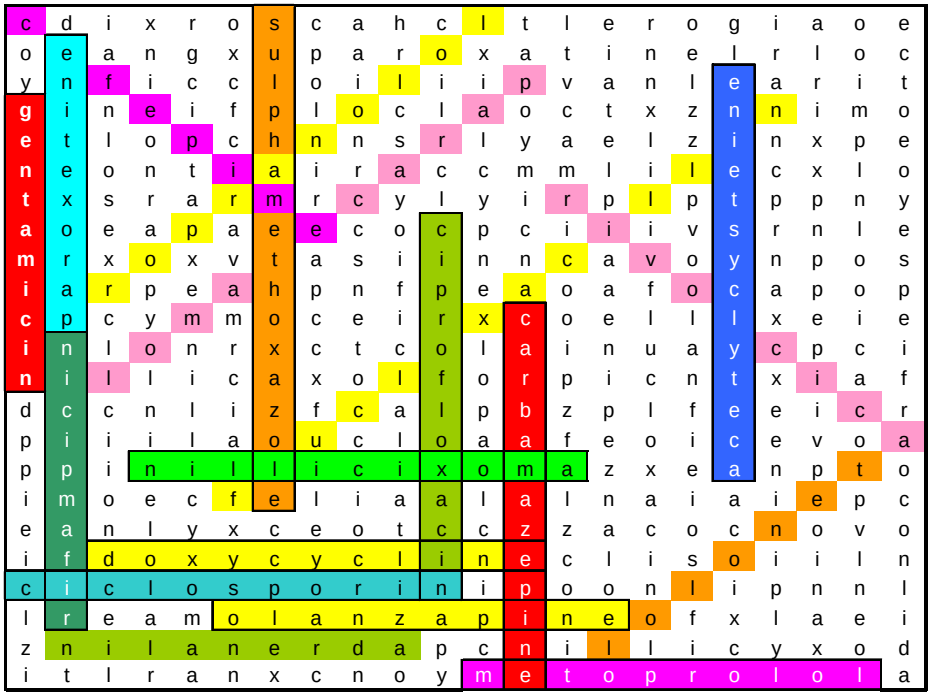
Check your answers on the back page.

Answers to the Drug Name, Word Search Quiz

The grid below shows the 19 highlighted drug names as they appeared in the grid.

The list on the right and colour codes should help with the identification of each name. Note that some names are written backwards, diagonally and some from bottom to top.

There were no all correct answers. Many entries ignored the accepted correct spelling and circled a name that was close to the correct one. There were quite a few miss-spelled and "pseudo" - drug names in the grid to trap the unwary! (e.g. there is no such drug as "*ciprofloxacillin*" but you will find it on the internet if you Google it!



- olanzapine
- doxycycline
- gentamicin
- cefepime
- carbamazepine
- rifampicin
- adrenalin
- ciprofloxacin
- amoxicillin
- flucloxacillin
- ciclosporin
- paroxetine
- aciclovir
- atenolol
- metoprolol
- propranolol
- paracetamol
- acetylcysteine
- sulphamethoxazole

Corrections

It has been noted that in the word search puzzle grid in the last issue, the two leftmost columns of the letter grid were cut-off in the printing process. Now we understand why there were no correct entries as it would be impossible to find all of the drugs. Perhaps we can have another competition in the next issue to make up for this. Also, someone has kindly pointed out that sulfamethoxazole is the new INN spelling for sulphamethoxazole. Apologies. *Ed*

Alphabet Quiz Answers

Ascorbic acid, **B**asal ganglia, Common **C**arotid arteries, **D**eferasirox or Deferiprone, **E**jection fraction, **F**entanyl, Generic, **H**LA (Human Leukocyte Antigen) system, Iatrogenic, **J**aundice, **K**ernicterus, **L**ead, **M**etformin, **N**aphthalene, **O**xytocin, **P**seudomembranous colitis, **Q**uinine, **R**ibotlavin, **S**ucrose, **T**urbohaler, **U**ric acid, **V**estibulocochlear nerve, **W**arts, **X**enograft, **Y**ersinia pestis, **Z**oledronic acid.

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