Introductory Pharmacology : Multiple Choice Questions : Bachelor Of Nursing : Southern Cross University

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MULTIPLE CHOICE QUESTIONS AND ANSWERS

WEEK 01

Q. All cells progress through basically the same cell cycle, including:

A. four active phases and a resting phase

Q. The cell membrane is composed of:

A. a phospholipid structure

Q. The components of the cell responsible for degrading waste are called:

A. lysosomes

Q. The ribosomes are important sites for:

A. production of proteins

Q. The basic unit of the human structure is:

A. the cell

Q. A human cell placed in salty seawater will:

A. shrivel and die from water leaving the cell

Q. The sodium-potassium pump maintains a negative charge on the cell membrane by:

A. active transport

Q. An example of a drug allergy or hypersensitivity of the immune system would be:

A. breathing difficulty after an injection of penicillin

Response Feedback:

Breathing difficulty after an injection of penicillin is an example of a drug allergy, while all of the other choices are examples of adverse drug reactions.

It is important that you begin to ask the question "is this side effect possibly caused by a hypersensitivity reaction or is it just an adverse effect of the drug?"

Corticosteroids often have a drying effect, and cause dry mouth, Bronchodilators often mimic the actions of adrenaline in the lungs, which open them up but can act like adrenaline on the receptors of the heart, speeding it up. Diuretics increase excretion of salt and water from the body, but people may complain that this makes them run to the toilet several times a day.

Importantly, some people will say they have had allergies to medications, when they have just had adverse effects. When you hear about allergies always do further questioning until you are satisfied with which one the person experienced.

While one may expect that a skin rash is always an allergic reaction, pimples caused by anabolic steroids, corticosteroids, and phenytoin (as well as many other rashes and skin eruptions) do not involve the immune system and therefore are not considered allergies. While a patient may report being allergic to a drug, in some settings it is important to determine whether it is actually an allergy or whether it is a side effect.

Q. Apply your knowledge: What effect would exercise have on absorption of a drug that is administered by intramuscular injection?

A. Exercise improves absorption of a drug after intramuscular injection because it causes an increase in skeletal muscle blood flow

Response Feedback:

Exercise improves absorption of a drug after intramuscular injection because it causes an increase in skeletal muscle blood flow.

Q. An example of a drug that exerts its actions by directly affecting enzymes is:

A. aspirin

Response Feedback:

Aspirin and Non-Steroidal Anti-inflammatory drugs affect an enzyme called cyclooxygenase. (Note the ...ASE at the end of that word, which tells you it is a protein, specifically an enzyme, which catalyses (speeds up) a reaction). Specifically, cyclooxygenase helps speed up the synthesis of prostaglandins. When we take aspirin, we decrease prostaglandin synthesis because we affect the enzyme that makes prostaglandins.

A calcium channel blocker is an antagonist, blocking (antagonising) the calcium channel. A Tums antacid works by chemical actions, simply neutralising acid. Salbutamol is a Beta 2 selective adrenaline agonist (it is like adrenaline, binding to adrenaline receptors, but it only binds selectively to one type of adrenaline receptor to reduce the adverse effects.)

Q. Clinical pharmacology is the study of:

A. drugs used to treat, prevent, or diagnose disease

Response Feedback:

Clinical pharmacology is the study of drugs and their use in humans. In addition to the basic science of drugs, clinical pharmacology has the added focus on the application of pharmacological principles and methods in the real world. Clinical pharmacology connects the gap between medical practice and laboratory science. The main objectives are to promote the safety of prescription, maximise the drug effects and minimise the side effects.

Question: what is the difference between pharmacology and clinical pharmacology?

Answer: Some people argue that there is no difference, as both are umbrella terms under which pharmacokinetics, pharmacodynamics, and toxicity drug interactions... fall.

But Clinical Pharmacology does not normally include the early studies in the lab performed on cell lines. In exchange, clinical pharmacology generally has more of an emphasis on the clinical use of drugs. My master's degree was in 'clinical pharmacology' because the main portion of that was a clinical trial on humans, while my PhD was a degree in pharmacology because it included studies in cell lines and then in

animals but not humans. I could not consider both degrees to be in the area of clinical pharmacology, but I could consider both to be in the area of pharmacology.

Q. The 'pregnancy categories' or formally named Australian Drug Evaluation Committee (ADEC) pregnancy categories:

A. indicate a drug's potential or actual teratogenic effects

Response Feedback:

The ADEC classification of drugs in pregnancy categorises drugs from category A (no identified risk to the foetus after the drug has been taken by large numbers of pregnant women) to X (teratogenic agent). this is important but you do not need to know the difference between the three B Categories. The B category is not strictly hierarchical. In some cases, a B is less safe than a C. B is the category that is used in Australia for drugs that have had limited human data, so don't think that a B drug is always safer than a C.

Category A

Drugs which have been taken by a large number of pregnant women and women of childbearing age without any proven increase in the frequency of malformations or other direct or indirect harmful effects on the foetus having been observed.

Category B1

Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed.

Studies in animals have not shown evidence of an increased occurrence of foetal damage.

Category B2

Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed.

Studies in animals are inadequate or may be lacking, but available data show no evidence of an increased occurrence of foetal damage.

Category B3

Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed.

Studies in animals have shown evidence of an increased occurrence of foetal damage, the significance of which is considered uncertain in humans.

Category C

Drugs which, owing to their pharmacological effects, have caused or may be suspected of causing, harmful effects on the human foetus or neonate without causing malformations. These effects may be reversible. Accompanying texts should be consulted for further details.

Category D

Drugs which have caused, are suspected to have caused or may be expected to cause, an increased incidence of human foetal malformations or irreversible damage. These drugs may also have adverse pharmacological effects. Accompanying texts should be consulted for further details.

Category X

Drugs which have such a high risk of causing permanent damage to the foetus that they should not be used in pregnancy or when there is a possibility of pregnancy.

Q. Receptors:

A. are proteins on cell membranes or within the cell that react with specific chemicals

Response Feedback:

A receptor is a protein molecule (usually embedded on the surface of a cell, although some receptors for lipid soluble substances are located on the inside of the cell) that receives chemical signals from outside the cell. When the chemical substances bind to a receptor, they normally direct the cell to do something, such as divide, die, or allow specific substances to enter or exit the cell. A chemical substance that binds to a receptor can be a peptide, neurotransmitter, hormone, drug or toxin.

Numerous receptor types are found in an average cell and each is linked to a specific biochemical pathway. The way chemical substances bind to receptors is often likened to a lock and key, with only the molecules shaped in the right molecular conformation binding to the key (receptor) and opening it. When a molecule binds to a receptor, it can activate or inhibit the receptor's associated biochemical pathway. However, some chemical substances (antagonists) simply block receptors from binding to molecules without inducing any response themselves.

Q. Much of the biotransformation that occurs when a drug is taken occurs as part of:

A. the first-pass effect through the liver

Response Feedback:

The hepatic first-pass is responsible for reducing the concentration of the orally consumed drug before it reaches systemic circulation. After a drug is swallowed, it is absorbed by the digestive system and enters the hepatic portal venous system. It is carried through the portal vein into the liver before it reaches the rest of the body. The liver metabolises many drugs, sometimes to such an extent that only a small amount of active drug emerges from the liver to the rest of the circulatory system. This first pass through the liver thus greatly reduces the bioavailability of the drug.

In some cases, the drug is converted into the active drug after going through the first pass.

To avoid the first pass, drugs can be taken sublingually, or as a suppository, as blood from the mouth and rectum goes straight to the right side of the heart instead of the portal venous system. Other routes of administration that avoid the first pass include intravenous, intramuscular and via transdermal patches.

Q. The generic name of a drug is:

A. a shorthand version of the chemical name of the drug

Response Feedback:

The generic name is the shorthand version of the chemical name (see relevant slide in lecture). The brand name (trade name) is given by the pharmaceutical company that developed it. It is best to learn pharmacology with reference to the generic name.

Once a drug's patent has expired, other companies are allowed to sell that drug by the generic name, not by the original brand name. That medication is a generic medication.

A generic drug must contain the same active ingredients as the original formulation. However, the binders used in a generic drug may not be the same as those used in the brand-name drug. Currently in Australia, there is a requirement that the bioavailability is also tested and proven to be the same in healthy

volunteers. In Australia, it is often recommended that a drug be dispersed in the generic form if one is available, which helps keep down the cost of drugs and health care. Some prescribers specify that a drug is "dispensed as written" (DAW), which is most important in drugs that have narrow safety margins.

So, if the doctor or prescriber writes DAW on the prescription, the pharmacist cannot legally substitute a generic medication for the brand name.

Q. Drug X is highly metabolised in the liver to a substance that is inactive. Drug X may need to be taken:

A. by sublingual administration

Response Feedback:

Sublingual administration will avoid the first pass mechanism, as drugs administered in that way go straight into the arterial blood. The other forms of administration will still go into the hepatic portal venous system and directly to the liver.

If a medication is able to be taken orally, in most cases, they best taken on an empty stomach (although there are numerous examples of drugs that need to be taken with food). Some foods increase acid production, speeding the breakdown of the drug and preventing absorption and distribution of the drug. Check the drug monograph before giving instructions to the patient and try to remember the exceptions to this guide.

Q. Affinity is defined as:

A. the extent of the binding of a drug to a receptor (or protein). How strong the drug binds to the receptor or protein.

Response Feedback:

Please see Bullock for definitions of affinity, selectivity, efficacy and potency. Also please be aware of the definition of Selective toxicity:

Selective toxicity is the ability of a drug to be toxic to foreign cells or to be toxic to abnormal human cells. At the same time, there is little toxicity to normal cells. The way we do that is to find things about abnormal or foreign cells that are different to normal human cells. In the case of infectious agents, it may be something in the cell wall structure which is specific to that organism. It may be that we target the nutritional needs of the infectious agent (for instance, bacteria need to synthesise their folic acid, but we get folic acid in the diet. If we selectively target the synthesis of folic acid, that drug should not have many adverse effects. The way we target abnormal human cells is to once again find those differences. So, for instance, cancer cells are very rapidly dividing, so we can target cells going through the cell cycle. Unfortunately, that target is less precise, because many cells in the gut and bone marrow are proliferating pretty rapidly as well. So, with cancer therapy, it is selective but not selective enough to be ideal in most cases.

Q. Clinical trials designed to test drugs are divided into different stages, called phases. The earliest phase trials may look at whether a drug is safe, or the side effects it causes. A later phase trial aims to test whether a new treatment is better than existing treatments.

There are 3 main phases of clinical trials – phases 1 to 3. But some trials have an earlier stage called phase 0, and there are some phase 4 trials done after a drug has been licensed.

While we have not discussed drug studies very much, using the information that you do know, please hypothesise on the following.

Phase 1 drug studies involve:

A. healthy human male volunteers who are often paid for their participation

Response Feedback:

In Phase 1 trials, researchers test an experimental drug or treatment in a small group of young healthy men for the first time to evaluate its safety, determine a safe dosage range, and identify side effects. Women are not normally used because of the potential risk to the ova.

In Phase 2 trials, the experimental treatment is given to a larger group of people (100–300) who have the disease that the drug is designed to treat to see if it is effective and to further evaluate its safety.

In Phase 3 trials, the treatment is given to large groups of people (1,000–3,000) to confirm its effectiveness, monitor side effects, compare it to commonly used treatments, and collect information that will allow it to be used safely.

In Phase 4 trials, post-marketing studies delineate additional information, including the treatment's risks, benefits, and optimal use.

Before pharmaceutical companies start clinical trials on a drug, they conduct extensive preclinical studies to determine whether they are tolerated in animals.

Q. Suppositories, in general, when inserted into the lower third of the rectum:

A. avoid the hepatic first pass

Response Feedback:

A suppository is a drug delivery system that is inserted into the rectum (rectal suppository), vagina (vaginal suppository) or urethra (urethral suppository), where it dissolves or melts and is absorbed into the blood stream.

Suppositories are used to deliver both systemically and locally acting medications. When inserted into the lower portion of the rectum, the drug avoids the hepatic-portal-venous system and thus bypasses the "first pass" to the liver. However, inserting the suppository higher will not avoid the first pass, because the blood from that area travels to the liver. Suppositories are occasionally used when the drug would be inactivated in the liver if taken orally.

Sublingual applications also bypass the portal venous system and thus bypass the first pass of the liver.

The following is an example of a multiple choice question that tests your knowledge of the feedback

Sublingual administration of a drug always ensures:

A) rapid action

B) avoidance of hepatic first pass

C) minimal adverse effects

D) all of the above

Answer: B

Q. Apply your knowledge: Administering medications via an NGT (nasogastric tube) involves crushing the medication and dissolving it in water first. Therefore, administering enteric coated medication by NGT is:

A. not advisable

Response Feedback:

*An enteric coating is a barrier applied to oral medication that attempts to control the location in the GIT where it breaks down or is absorbed**. Most enteric coatings have a surface that is stable at the highly acidic environment of the stomach, but breaks down rapidly at a less acidic pH. The drugs that have these*

coatings should not be chewed or crushed, as that disturbs the coating. Obviously, this goes against the need to crush medicines that are administered by NGT.

***The GIT is the gastrointestinal tract which includes the mouth, all the way down to the anus. Enteric coating attempts to get the - medicine down past the stomach in many cases, because*

- the drug could damage the lining of the stomach or

- the drug could be destroyed in the acidic environment of the stomach.

Other drugs have a mild enteric coating so that the patient does not taste the bitterness of the drug OR the drug does not affect the mouth or oesophagus, or it does not become activated until it reaches the stomach. So what I meant by "attempts to control the location in which it breaks down or is absorbed" is that the drug manufacturers decide where in the GIT it is best to be stripped of its protective coating, and then design a suitable protective coat that in most instances dissolves at that point and not sooner (or later - as you can imagine, if the coating is 'too good', it will end up whole in the faeces!).

Q. The half-life of a drug is 2 hours and Mrs CV has taken 100mg. How much would be left in her system after 4 hours?

A. 25mg

Response Feedback:

All pharmacokinetic processes (the absorption rate, distribution to the tissues, the speed of biotransformation and the speed at which the drug is excreted) are taken into consideration when determining the half-life of the drug.

The half-life of a drug is the time required for a substance (drug, radioactive nuclide, or other) to lose one-half of its pharmacologic, physiologic, or radiological activity. If a person takes a 100mg tablet of drug X with a half-life of 2 hours, one expects there to be 50mg remaining 2 hours after administration.

Importantly, many students believe this means that the drug is completely out of the system in four hours, but this is an exponential formula. Two hours after the first half-life (four hours after administration), the amount remaining is 25 mg!

AJ has taken a 40 mg tablet of Drug Y (with a 3 hour half-life). How much of the drug is expected to be in her system after 9 hours?

Answer: 5mg. (After 3 hours = 20mg, after 6 hours = 10mg, after 9 hours = 5mg)

Q. Some laxative enemas are hypertonic in order to:

A. draw water into the lower gastrointestinal tract to soften stool

Response Feedback:

Hypertonic solutions have more osmotically active solutes than the adjacent cells. Hypertonic enemas therefore draw water into the lower gastrointestinal tract to soften stool.

Q. According to the Uniform scheduling of drugs and poisons in Australia, substances available from pharmacies are listed as Schedule:

A. Schedule 2

Response Feedback:

Schedule 2 (S2) drugs and poisons are available from pharmacies or from people licensed to sell the drugs.

Schedule 3 (S3) drugs and poisons require professional advice but are available from a pharmacy.

Schedule 4 (S4) drugs and poisons are otherwise known as prescription only medicines.

Schedule 8 (S8) drugs and poisons are otherwise known as Controlled Drugs. They are substances for therapeutic use that have high potential for abuse or addiction.

An example of a question derived from the feedback follows:

Controlled drugs are substances that:

A) are available for use but require restriction of manufacture, supply, distribution, possession and use to reduce abuse, misuse and physical or psychological dependence

B) have a moderate potential for causing harm, the extent of which can be reduced through the use of distinctive packaging with strong warnings and safety directions

C) require professional advice and should be available to the public from a pharmacist without a prescription

D) require professional advice from a pharmacist and should be available from a pharmacy or, where a pharmacy service is not available, from a licensed person

Answer: A, and controlled drugs are Schedule 8

Schedule 1 (Victoria) Traditional Chinese herbs. Intentionally left blank in other states and territories.

Schedule 2 Pharmacy Medicine: Substances, the safe use of which requires professional advice from a pharmacist, and which should be available from a pharmacy or, where a pharmacy service is not available, from a licensed person.

Schedule 3 Pharmacist Only Medicine: Substances, the safe use of which requires professional advice, but which should be available to the public from a pharmacist without a prescription.

Schedule 4 Prescription Only Medicine, or Prescription Animal Remedy: Substances, the use or supply of which should be by or on the order of persons permitted by state or territory legislation to prescribe and should be available from a pharmacist on prescription.

Schedule 5 Caution: Household substances—substances with a low potential for causing harm, the extent of which can be reduced through the use of appropriate packaging with simple warnings and safety directions on the label.

Schedule 6 Poison: Agricultural, veterinary and industrial substances—substances with a moderate potential for causing harm, the extent of which can be reduced through the use of distinctive packaging with strong warnings and safety directions.

Schedule 7 Dangerous Poison: Substances with a high potential for causing harm at low exposure and which require special precautions during manufacture, handling or use. These poisons should be available only to specialised or authorised users who have the skills necessary to handle them safely. Special regulations restricting their availability, possession, storage or use may apply.

Schedule 8 Controlled Drug: Substances which should be available for use but require restriction of manufacture, supply, distribution, possession and use to reduce abuse, misuse and physical or psychological dependence.

Schedule 9 Prohibited Substance: Substances which may be abused or misused, the manufacture, possession, sale or use of which should be prohibited by law except when required for medical or scientific research, or for analytical teaching or training purposes with approval of Commonwealth and/or state or territory health authorities.

Q. Drugs administered transdermally must be:

A. lipophilic

Response Feedback:

Drugs delivered transdermally need to be highly lipophilic (from Greek λίπος "fat" and φίλος "friendly"). Transdermal is a route of administration wherein active ingredients are delivered across the skin for systemic distribution. Examples include transdermal nicotine patches and testogel, a transdermal gel containing testosterone.

Q. Ointments are lipid-based preparations that act like an occlusive dressing to:

A. completely shut out the skin from the air, but allow sweating to still occur

Response Feedback:

An ointment completely shuts out the skin from the air but allows sweating to occur.

An ointment is a homogeneous, viscous, semi-solid preparation, most commonly a greasy, thick oil (oil 80% - water 20%) with a high viscosity, which is intended for external application to the skin or mucous membranes. They are used as emollients or for the application of active ingredients to the skin for protective, therapeutic, or prophylactic purposes and where a degree of occlusion is desired. They are often disliked by patients due to greasiness. A drug formulated into an ointment will penetrate the deeper layers of the skin.

The following is an example of a multiple choice question developed from the feedback:

A drug formulated into a(n) _____ will penetrate the deeper layers of the skin most effectively.

A) lotion

B) gel

C) ointment

D) cream

Answer: C (but in tests, the questions and answers will be randomised, so please do not memorise the answer-letter)

Q. An example of a drug that works by chemical action is:

A. one that neutralises acid

Response Feedback:

There are very few examples of drugs that work by chemical actions, as most are antagonists, agonists, or affect enzymes. Drugs that work by chemical actions include:

- *Injecting manitol as an osmotic diuretic*
- *Oral doses of activated charcoal, which is an adsorbent*
- *Magnesium salts for osmotic laxative (Epsom salts)*

Q. This is a formative question that was not specifically covered in the lectures but rather attempts to begin development of your thought process about drugs, and tries to show you how to work your way through multiple choice questions you do not know. You should try to work this out by thinking logically about the information you know.

Antineoplastic drugs (chemotherapy) often work by targeting rapidly proliferating cells. That is great, because the cancer cells are normally rapidly proliferating. Unfortunately, those therapies often have many adverse effects. Since they target rapidly proliferating cells, you would hypothesise that they will:

A. decrease proliferation of bone marrow cells resulting in anaemia and decreased white blood cells.

Response Feedback:

Cytotoxic drugs used in the treatment of cancer work by inhibiting the proliferation of dividing cells, with the malignant cells being the desired target. However, this has the adverse effect of also killing the cells that are rapidly reproducing, and thus impairing normal body function of hair, skin, GI tract and bone marrow. This is why patients on chemotherapy will lose their hair, develop anorexia (distaste for food) and become anaemic.

Cardiac cells, ova and kidney cells do not proliferate after birth.

The anaemia and other side effects caused by these drugs are considered adverse effects and are NOT hypersensitivity reactions.

Q. Following lower rectal administration, a drug:

A. is absorbed directly into blood vessels

Response Feedback:

The lower portion of the rectum avoids the first pass mechanism, and drugs administered by suppository will go straight into the blood circulation if not pushed into the upper rectum or colon.

Buccal administration refers to the pharmacological route of administration by which drugs diffuse into the blood through tissues of the buccal vestibule, the area inside the mouth between the lining of cheek and the teeth/gums. Buccal (as opposed to oral) administration usually results in a more rapid onset of action, since the medication need not pass through the digestive system and can be absorbed directly through the skin.

Q. Which drug is the most common cause of an anaphylactic reaction?

A. Penicillin

Response Feedback:

*Penicillin is the most common cause of anaphylaxis. Anaphylaxis typically presents symptoms in 5 to 30 minutes if exposure is intravenous and 2 hours if consumed orally. Anaphylaxis is a severe type I hypersensitivity reaction, which results in basophils and mast cells releasing histamine to dilate blood vessels and increase their permeability. Adrenaline, the physiological antagonist** of histamine is used to combat the manifestations of anaphylaxis. (This is discussed in more detail later this session; **the definition of physiological antagonist is that they do not compete for the same receptors, but their effects are diagrammatically opposite.)*

Mismatched blood transfusions involve a hypersensitivity type II reaction, the injected contrast dye used for imaging studies is extremely toxic to the kidneys; Salicylate (aspirin) sensitivity is a pharmacological reaction but not a true allergy, about 5-10% of asthmatics have aspirin hypersensitivity.

The type 1 hypersensitivity reactions are regarded as 'true allergies', and a reaction from types 2-4 are most often considered intolerances. Any of the hypersensitivity reactions can result in severe medical problems, but the allergy - the hypersensitivity type 1 reaction can result in the death within minutes. Adrenaline is the treatment of choice for the true hypersensitivity type 1 Anaphylactic shock.

Q. Prohibited substances (schedule 9) are substances that:

A. may be abused or misused. Their manufacture, possession, sale or use should be prohibited by law except when required for medical or scientific research, or for analytical teaching or training purposes

Response Feedback:

Prohibited substances are classified as Schedule 9 drugs and may be abused or misused. Their manufacture, possession, sale or use should be prohibited by law except when required for medical or scientific research, or for analytical teaching or training purposes.

Q. Which of the following simplistically defines the word pharmokinetics?

A. what the body does to the drug

Response Feedback:

Pharmacology is the broad umbrella term meaning the study of drug action, inclusive of pharmacokinetics, pharmacodynamics (what the drug does to the body) and toxicology (the study of the adverse effects of chemicals on living organisms).

Pharmacokinetics (Greek pharmakon "drug" and kinetikos "to do with motion"); is a branch of pharmacology dedicated to the determination of the fate of substances administered externally to a living organism. Pharmacokinetics of drugs includes information about

Absorption - the process of a substance entering the blood circulation.

Distribution - the dispersion or dissemination of substances throughout the fluids and tissues of the body.

Metabolisation (or biotransformation, or inactivation) – the recognition by the organism that a foreign substance is present and the irreversible transformation of parent compounds into daughter metabolites.

Excretion - the removal of the substances from the body (or in some cases the build-up of substances within the body).

Q. Intrathecal injection is a mode of drug delivery into:

A. cerebrospinal fluid

Response Feedback:

The word intrathecal normally refers to something occurring in or introduced into the arachnoid membrane of the brain or spinal cord. (theca, "within a sheath")

An intrathecal injection or simply "intrathecal" is a route of administration for drugs via injection into the spinal canal. This is useful in spinal anaesthesia and also in cancers and infections of the brain or spinal cord when the chemotherapy/antibiotic would not normally break the blood brain barrier.

Intrathecal injections are difficult to perform and can be extremely dangerous, potentially leading to the cerebral spinal fluid being contaminated with microorganisms or damage to the spinal cord nerves, so are reserved for conditions that absolutely need the injection there.

Q. Which form of hypersensitivity reaction is characterised by antibody-antigen complexes that precipitate out of the blood and lodge in tissues such as skin and joints, inducing an inflammatory response?

A. Type III hypersensitivity reaction

Response Feedback:

The hypersensitivity reaction characterised by antibody-antigen complexes that precipitate out of the blood and lodge in tissues such as skin and joints is called a type III hypersensitivity reaction. In drug hypersensitivity reactions, a type III is normally associated with antivenoms and antitoxins.

Q. The 70kg adult dose is 100 mg. My child is 7 kg, so I should give her:

A. nothing until a certified prescriber works out the dose

Response Feedback:

One never assumes that the dose for a child is simply a percentage of the adult dose. Children have decreased levels of liver enzymes, increased absorption and many other variables that differ from the adult.

Another point is that in neonates and infants, drug absorption through the skin is enhanced because the surface area to body weight is greater than that of adults.

In neonates and infants, drug absorption through the skin is:

reduced because the surface area to body weight is greater than that of adults

reduced because the surface area to body weight is less than that of adults

enhanced because the surface area to body weight is less than that of adults

enhanced because the surface area to body weight is greater than that of adults

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Q. An asthmatic takes a beta 2 bronchodilator and complains of a racing heart. This is:

A. a normal adverse reaction

Response Feedback:

Sympathomimetics (drugs that mimic the sympathetic nervous system's fight or flight response) and anticholinergics (drugs that block the parasympathetic nervous systems' rest and digest actions) often give the adverse effect of a racing heart, but that is not a hypersensitivity reaction.

Q. Individual drugs can be classified according to the following EXCEPT:

A. adverse drug reaction

Response Feedback:

Individual drugs can be classified according to therapeutic use, mode of action, or molecular structure, but classifying them according to adverse drug reaction is not useful.

Q. Which Australian Drug Evaluation Committee (ADEC) pregnancy category includes is a drug that has caused or is suspected of causing foetal harm, but not malformations?

A. Category C

Response Feedback:

A drug that has caused or is suspected of causing foetal harm, but not malformations is categorised as Pregnancy category C.

Q. This is a difficult question that requires you to apply your knowledge of protein binding.

Mrs S. is stabilized on two different medications that are highly bound to the same protein carrier.

One of those medications is an anti-seizure medication, as she has epilepsy.

She runs out of the other medication (not the one for her epilepsy)

She is now susceptible to:

A. having a seizure

Response Feedback:

If a patient is on two drugs that are highly bound to the same protein, and one of the medications is withdrawn, a number of additional binding spots are available on the protein carriers. This can lead to more of the drug binding and LESS of the drug being free and available. Remember that it is the free portion of the drug that is active. So there is less active medication available. She would be in danger of having a seizure.

You don't need to worry too much about protein binding right now but just make sure that you understand that it is one of the reasons for adverse drug reactions.

Q. The ability of the drug to achieve the desired result refers to its:

A. efficacy

Response Feedback:

Efficacy is basically the effectiveness of the drug. The antihypertensive drug that decreases the blood pressure by 11 mmHg is more efficacious than the one that decreases the BP by 4 mmHg.

Potency is a measure of drug activity expressed in terms of the amount required to produce an effect of given intensity. A highly potent drug evokes a larger response at low concentrations, while a drug of lower potency evokes a small response at low concentrations.

Efficacy is the ability to produce a desired or intended result.

Specificity is the ability to interact specifically with one type of receptor.

Please know these definitions. This question can be changed to any of the terms.

Q. When a drug acts through competitive inhibition of an enzyme it:

A. competes with the substrate (the natural substance that is normally acted on by that enzyme) for the active spot, and therefore can be overcome by giving more of the enzyme substrate

Response Feedback:

Competitive inhibition is reversible. The medication competes with the substrate for the active spot, and therefore if you give heaps of the substrate, the competitive inhibitor is much less effective.

In irreversible inhibition, the enzyme needs to be replaced, so the actions of the medication last longer than you would predict from the half life.

Please note that the author of your text is incorrect about non-competitive inhibition and incorrectly uses the term non-competitive inhibition and irreversible inhibition interchangeably. Non-competitive inhibition is reversible. Aspirin and non-steroidal anti-inflammatory drugs are irreversible inhibitors of the cyclo-oxygenase enzyme but that inhibition is not by a non-competitive way.

Q. If photosensitivity from a drug is caused by a hypersensitivity reaction, which type of reaction would this be?

A. Type IV hypersensitivity reaction

Response Feedback:

*In medicine, the term photosensitivity is used for abnormal reactions of the skin, and two types are distinguished, photoallergy and phototoxicity. If a drug causes a photoallergy, it is caused by a type IV hypersensitivity reaction and that is not a 'true allergy' because we should think of true allergies as being the hypersensitivity type 1 reaction that is treated with adrenaline injection. Photoallergic drug reactions occur when UV energy causes the drug to bind to protein on epidermal cells. The immune system comes in 24 to 72 hours later**, causing an angry red pruritic (itchy), eczematous eruption.*

***Type IV reactions are also called cell mediated 'allergic' reactions or delayed hypersensitivity reactions and do not happen immediately. They are not a 'true allergy' but should rather be considered an intolerance*

Q. Drugs are metabolised by the liver to make them more:

A. hydrophilic

Response Feedback:

The liver makes drugs more hydrophilic (water loving), thereby making them easier to excrete.

Hint: if you do not know the definition of any word in the MC question or answer, make sure that you look it up! In the weekly quizzes, it is acceptable to search for the answers because this develops the skill of information literacy, or the ability to find accurate information quickly.

Amphipathic (from the Greek word αμφις, amphis: both and φιλία, philla: love, friendship) means a molecule that possesses both hydrophobic (water hating; lipid like) and hydrophilic elements, such as are found in phospholipids of biological membranes.

Q. By which route are drugs NOT subject to the physiological process of absorption through a blood vessel wall?

A. Intravenously

Response Feedback:

Medications delivered subcutaneously, intradermally, and intramuscularly all need to be absorbed through a blood vessel wall (meaning that they should be lipophilic so that they can cross through the blood vessel wall), while intravenous medications are delivered directly into the blood.

Q. Oseltamivir is used to treat influenza A and B

It reversibly binds to an enzyme called neurominidase that the viron has but humans do not have.

When the drug is bound to the enzyme, the enzyme cannot perform its function.

Oseltamivir acts:

A. as competitive inhibitors

Response Feedback:

Competitive inhibition is a form of enzyme inhibition. It normally binds to the active site on the enzyme preventing binding to the substrate. If the enzyme cannot bind to the substrate, the normal end product cannot be produced.

While most competitive inhibition binds to the active site of the ENZYME, there are some competitive inhibitors that bind to the substrate, just like the normal enzyme would.

One example of that is found with the sulfonamides - they act like the enzyme, and bind to the substrate. But, that binding does not produce the thing that the bacteria need.

Sulfonamides are very similar in structure to an enzyme that is essential to the synthesis of folic acid. If something is involved in competitive inhibition of that enzyme, no folic acid is formed. If there is no folic acid, there is no DNA synthesis. If there is no DNA synthesis, there is no replication of bacteria.

Q. After a single dose of a drug with a half-life of 8 hours, how much of the drug remains after 16 hours?

A. 25%

Response Feedback:

After a single dose of a drug with a half-life of 8 hours, 25% would remain after 16 hours.

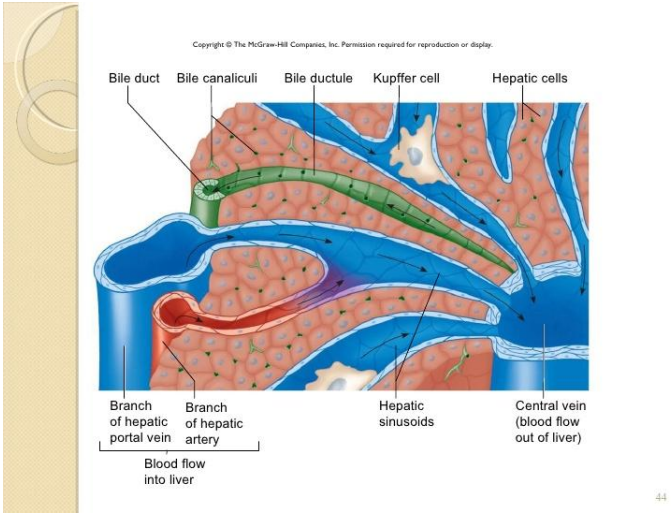
Note: on this question, a different example is likely in the tests, so please try to understand the answer.

Q. Pharmacological effect is achieved by:

A. the portion of free or unbound drug

Response Feedback:

Drugs are often transported attached to proteins in the blood (for instance 40% protein bound), mainly albumin and the globulins. Therefore, a person who has a tumour that is secreting high amounts of protein may need more of a highly protein bound drug. Conversely, a person with too little protein in their diet will have a greater level of free drug, leading to an increased drug effect. (They need less of the drug to get the same effect)



Question: A drug bound to a plasma protein is has 'reduced drug clearance', because it liver. How prevented from being metabolised in the does the bound drug leave the system?

Answer: Using the picture below, think of this at the cellular and even molecular level. IMAGINE the drug (a tiny molecule) going through the portal venule and on through the sinusoid of the liver (towards the central vein) attached to a protein (another molecule but often much bigger).

Let's say that the drug is 40% bound to proteins. As it passes in the blood of the sinusoids, nearly all of the unbound drug goes into the liver to be metabolised. That leaves no unbound drug in the blood leaving the liver. Since the equilibrium needs to be 40% bound to proteins, some of the medication disassociates from the protein carrier, and the next time the drug goes through the liver, that unbound portion gets metabolised.

How is it metabolised?

Once inside the liver cell, the drug molecule is bombarded by enzymes called Cytochrome P450 family of enzymes.

The enzymes (proteins that catalyse chemical reactions) change the drug molecule into a slightly more water-soluble molecule.

Some of the drug at that point go into the bile canaliculi (green pathway) to be excreted with the bile and ultimately the faeces. Some of the substance (the water soluble portion) re-enters the blood through the liver sinusoids, goes through the central vein, off into systemic circulation and on to the kidneys for excretion.

Bullock states that "as globulin levels increase with age, this factor has to be taken into account when using highly protein-bound drugs in the elderly". However other sources agree that "age-related changes in protein binding are usually not clinically important in drug therapy." Age-related physiological changes, such as decreased renal function, decreased hepatic function and decreased cardiac output, generally produce more clinically significant alterations in drug disposition than that seen with alterations in drug plasma protein binding. Grandison; Clinical Pharmacokinetics 2000 38(3): 271-90 (and others)

Q. The measure of drug activity expressed in terms of the amount required to produce an effect of given intensity is called:

A. potency

Response Feedback:

Potency is a measure of drug activity expressed in terms of the amount required to produce an effect of given intensity. A highly potent drug evokes a larger response at low concentrations, while a drug of lower potency evokes a small response at low concentrations.

Efficacy is the ability to produce a desired or intended result.

Specificity is the ability to interact specifically with one type of receptor.

Please know these definitions. This question can be changed to any of the terms.

Q. Competitive inhibition slows down the rate of normal chemical reactions because:

A. at any given moment, the enzyme may be bound to the inhibitor or the substrate

Response Feedback:

In competitive inhibition, at any given moment, the enzyme may be bound to the inhibitor, the substrate, or neither, but it cannot bind both at the same time.

Q. Glyceryl trinitrate is almost 96 per cent destroyed by the liver on its first journey through. It is therefore referred to having a:

A. high hepatic first-pass effect

Response Feedback:

When a high amount of a drug is destroyed on the first-pass through the liver, the drug has a high hepatic first-pass effect.

Glyceryl trinitrate and other drugs that have a high hepatic first-pass effect are administered by a way that avoids the liver the first time around. For Glyceryl trinitrate buccal administration or patches are appropriate.

Q. Phase 1 metabolism of a drug involves:

A. Cytochrome P450 (CYP) enzymes

Response Feedback:

Drug metabolism is divided into three phases, the most important of which are phases I and II. In phase I, enzymes such as cytochrome P450 oxidases modify the drug chemically by drug processes such as oxidation or reduction. Solubility and pharmacological activity are altered through this process.

Phase II reactions conjugate the drugs to polar substances to make them water soluble.

Our main goal with each of these processes is to be able to excrete the medications, so these processes generally make the drug more water soluble.

Q. Certain drugs can increase the enzymes in the liver, and are called liver enzyme inducers. Others may inhibit a particular liver enzyme. In that case, you would see for instance that it inhibits CYP3A4.

If you see that a medication induced a particular enzyme, you know that it:

A. increases a drug's metabolism

Response Feedback:

Medications that are liver enzyme inducers may increase a drug's metabolism. An example is comparing the metabolism of alcohol in a drinker vs. non-drinker; the drinker has increased levels of enzymes that not only metabolise alcohol, but also metabolise other drugs. Remember though, that some medications are metabolised to the active form, so the medication that is a liver enzyme inducer may not always inactivate the medication.

Likewise, a liver enzyme inhibitor may have a different effect for different medications, increasing the action of some medications and decreasing the action of other medications. When you hear that a medication affects one of the cytochrome P450 (CYP) enzymes, make sure that the person is not on another medication that is affected. You may need to go back to the prescriber.

Q. A drug mechanism that works to neutralise stomach acid is considered to be:

A. a chemical action

Response Feedback:

The neutralisation of stomach acid is simply a chemical action. Very few drugs work by chemical actions. How do most work?

Q. This is an example of a question from the table that I gave you in the enclosing folder.

Drugs with generic names that end in the suffix -pril are members of the drug group called:

A. angiotensin-converting enzyme inhibitors

Response Feedback:

Angiotensin-converting enzyme inhibitors end in -pril; Serotonin receptor antagonists end in -setron. You do not have to spend much time on drug nomenclature, but know the ones below before the Mid Session Exam. The olol suffix will be covered in the second portion of the session.

-prazole	Proton-pump inhibitor	Omeprazole
-sartan	Angiotensin receptor antagonists	Valsartan
-vir	Antiviral drug	Acyclovir
-pril	ACE inhibitors	Captopril
-olol	Beta blockers	Timolol

Q. Which one of the following factors would you expect to decrease the rate of drug absorption from the small intestines?

a. A GIT infection that yields rapid transit and diarrhoea

Response Feedback:

A GIT bug that yields diarrhoea would be likely to decrease absorption of drugs. All other factors listed (increase in gut flow, small sized drug molecule and un-ionised drug states) would increase absorption form the small intestines.

Q. Drugs that are lipophilic may need to be carried by:

a. albumin, globulin or lipoproteins

Response Feedback:

Lipophilic drugs often cannot float around the blood stream without a carrier molecule. Since albumin is alkalotic, acidic and neutral drugs will primarily bind to albumin. If albumin becomes saturated, then these drugs will bind to lipoprotein. Basic drugs will bind to the globulins and glycoproteins.

Clearance of an acidic drug by the kidneys may be increased by alkalising the urine. Alkalisation will promote the excretion of a weak acid like aspirin, and prolong the duration of a weak base like atropine.

Q. Generally, drugs are best absorbed from the gastrointestinal tract if they are:

a. lipophilic

Response Feedback:

Yes, drugs are generally best absorbed from the gastrointestinal tract if they are lipophilic. Alcohol is an exception to that, as it is only slightly soluble in oil and mainly hydrophilic (water loving) but 100% is absorbed.

Q. This is a formative question that may take some time to work out, and you may not get it the first time.

a. A partial agonist can be as effective as an antagonist

Response Feedback:

A partial agonist can be as effective as an antagonist.

Inverse agonists are often more simply termed antagonists due to the fact that they bind as agonists but result in the opposite effect expected from the binding.

***Question: Please explain "a partial agonist can be as effective as an antagonist".*

Answer: There was a theory about phytoestrogens: being partial agonists, they may be able to provide extra oestrogen if the person needed extra (thereby eliminating peri-menopausal symptoms) and could also reduce the negative effects of too much oestrogen in the patients who had so much endogenous oestrogen that they were susceptible to breast cancer. Phytoestrogens are partial estrogen agonists in the adult male mouse. S Mäkelä, R Santti 1995

Well it turns out that they are not as good as it was originally hoped (although you still find the theories supporting some cell studies Naringenin: a partial agonist on estrogen receptor in T47D-KBluc breast cancer cells Sunzoo Kimand Tae In Park2012) AND the new drugs are very good as they antagonise the specific receptors in the breast without antagonising the other receptors.

But let us say that we found Drug A that was a very weak partial agonist to oestrogen receptors. If you fill up the oestrogen receptors in the breast tissue with Drug A, heaps of Drug A is hanging around and in effect not allowing oestrogen to bind. Drug A may be nearly as good as an antagonist in that situation.

MULTIPLE CHOICE QUESTIONS AND ANSWERS

WEEK 02

Q. Diffusion of CO2 from the tissues into the capillary blood:

A. occurs if the tissue concentration of CO2 is greater than that in the blood

Response Feedback:

Both oxygen and carbon dioxide diffuse down their concentration gradients, so if the blood is being recirculated without gas exchange at the lungs, the CO2 will not leave the tissues.

After diffusion from the alveoli into pulmonary capillary blood, oxygen is transported principally in combination with hemoglobin to tissue capillaries, where it diffuses down a partial pressure gradient into cellular mitochondria. Carbon dioxide, formed in the cells from oxygen-dependent metabolic pathways, diffuses into tissue capillaries along its partial pressure gradient and is transported to the alveoli.

Q. Your patient presents with pulmonary oedema. Which of the following most accurately describes the fluid/oedema?

A. The fluid is in the interstitial spaces and alveoli, which directly impacts on the ability to exchange gases

Response Feedback:

Pulmonary oedema is a condition in which fluid is forced into the parenchyma (or functional tissue) of the lungs. As such, the ability of the lungs to exchange gases is directly impaired. The most common reason for pulmonary oedema is left sided heart failure, because as blood is not able to go forward, it backs up increasing the pressure in the vessels of the lungs. The increased pressure forces exudate all through the lungs. We will talk about the appropriate therapy for this condition when we talk about the cardiovascular system but right now, it is important that you can distinguish between this condition and the other lung disorders that involve fluid:

A pleural effusion is excess fluid that accumulates in the pleural cavity, the fluid-filled space that surrounds the lungs. This excess can impair breathing by limiting the expansion of the lungs.

Pneumonia is an inflammatory condition of the lung affecting primarily the microscopic air sacs known as alveoli. The fluid in this case is from the vigorous response of the immune system, which flood the area with immune cells. Because this area has no pain receptors, PNEUMONIA IS OFTEN SILENT (is not associated with pain or other frank symptoms). Microorganisms can sometimes go from the functional tissue of the lungs into the pleural space, causing pleuritis.

Pleurisy (also known as pleuritis) is an inflammation of the pleura, the lining surrounding the lungs. This is very painful, and can become a clinical emergency because microorganisms and their toxins can easily reach the blood!

A pleural effusion can also occur. A pleural effusion is an excess fluid that accumulates in the pleural cavity, the fluid-filled space that surrounds the lungs. This excess can impair breathing by limiting the expansion of the lungs.

Q. The type II cells of the walls of the alveoli function to:

A. secrete surfactant

Response Feedback:

Type II alveolar cells secrete surfactant. These cells develop that ability in the last trimester of pregnancy, and premature babies may have deficiencies in surfactant.

Infant respiratory distress syndrome (IRDS), also called neonatal respiratory distress syndrome, respiratory distress syndrome of newborn, or surfactant deficiency disorder (SDD), is a condition in premature infants caused by insufficient surfactant production.

IRDS affects about 1% of newborn infants and is the leading cause of death in preterm infants. The incidence decreases with advancing gestational age, from about 50% in babies born at 26–28 weeks, to about 25% at 30–31 weeks. The syndrome is more frequent in infants of diabetic mothers and in the second born of premature twins.

Q. Which of the following is most critical for respiration (exchange of gasses at the level of the alveoli) to occur?

A. a short distance for diffusion from the alveoli to the capillary

Response Feedback:

For respiration to occur, there must be a short distance for diffusion from the alveoli to the capillary.

In physiology, respiration is defined as the exchange of gases (the transport of oxygen from the outside air to the cells within tissues, and the transport of carbon dioxide in the opposite direction). The very small distance for diffusion in the lungs (qualities of the alveoli and capillaries) is critical to the respiration process. Disorders that alter these will be disorders that affect respiration.

Ventilation is the movement of air in and out of the lungs. The inspiratory muscles, elastic properties of the lungs (for expiration), and adequate diameter of the airways are necessary to move the air. Disorders that affect these will affect ventilation.

Q. People with seasonal rhinitis experience irritation and inflammation of the nasal passages and passages of the upper airways. Treatment for these people might include:

A. topical nasal steroids

Response Feedback:

Topical nasal steroidal decongestants are effective in reducing the symptoms associated with allergic rhinitis. Use of topical nasal steroids in acute infections is contraindicated. The onset of these drugs is not immediate and may require up to one week to cause changes.

One of the main inflammatory mediators released with allergic rhinitis is histamine, and as such, second generation antihistamines (H1 blockers) such as loratadine and fexofenadine are often beneficial as well. First generation antihistamines such as diphenhydramine would be helpful but those break the blood brain barrier and are associated with many adverse effects.

Q. First generation antihistamines (H1 antagonists) such as diphenhydramine do all of the following EXCEPT:

A. Cause a significant reduction in stomach acid

Response Feedback:

Antihistamines are classed as first generation or second generation, depending on whether they break the blood brain barrier, causing drowsiness (first generation) or not. If an individual is not getting the response they desire from one antihistamine after one week, they should try another, as different individuals respond to different antihistamine, but it is best to stay away from the first generation antihistamines because they are associated with the development of Alzheimer's disease and drowsiness.

Antihistamines bind to the H1 receptor and not well at all to the H2 receptor that is on parietal cells that secrete hydrogen ions. As such, one would not use the H1 blockers (antihistamines) to decrease stomach acid. One would use the H2 blockers, which are not called antihistamines.

Q. To which drug group do many cough suppressants belong?

A. Opioid narcotics

Response Feedback:

Opioid narcotics like dextromethorphan, codeine and morphine exhibit their antitussive effects by binding to the μ-opioid receptor in the Central Nervous System (CNS). Other points to remember include:

Cough suppressants should not be given to children under the age of two years.

Naloxone is a μ-opioid receptor competitive antagonist that is used in opioid (heroin; morphine) overdose.

A question derived from the feedback is as follows.

Cough suppressants should not be given to children under:

A) 5 years

B) 4 years

C) 3 years

D) 2 years

Q. Which of the following is INCORRECT about histamine (H1):

A. It causes vasoconstriction

Response Feedback:

Histamine does NOT cause vasoconstriction - it causes dilation. That is why one gets HYPOtension when experiencing an anaphylactic shock. Thousands of mast cells are releasing histamine, which dilates the blood vessels so much that the body goes into shock.

To counter the effects of histamine, adrenaline or one of the medications that selectively hits the adrenaline alpha 1 receptor can be used. Those constrict most blood vessels.

Q. Acetylcysteine is an example of:

A. A mucolytic agent

Response Feedback:

Acetylcysteine is a mucolytic agent, like bromhexine and dornase alpha. Acetylcysteine is also the antidote for paracetamol toxicity but it must be taken soon after the overdose.

An example of an expectorant is guaifenesin.

An example of a second generation antihistamine is loratadine.

An example of a cough suppressant or antitussive agent is codeine or other opioids.

Please make sure that you know one example of the medications we discuss.

Q. Antitussives are cough suppressants and as such are useful in blocking the cough reflex and preserving the energy associated with prolonged, non-productive coughing. Antitussives (on their own) are best used with:

A. people with a dry, irritating cough

Response Feedback:

An antitussive (alone) is best on a dry, non-productive cough, and asthma, COPD, and postoperative conditions involve a productive cough. If a cough suppressant is used alone in a person who has a productive cough, the mucus could dry and create a mucus plug, or help cause an infection. Antitussive agents are opioid based medications that actually suppress the cough and are often sold in cough medicine with an expectorant or mucolytic agent to aid in getting the mucus out of the airways.

Overall, the efficacy of cough medication is questionable, particularly in children. A 2012 Cochrane review concluded that, "There is no good evidence for or against the effectiveness of OTC medicines in acute cough."

In coughs related to upper respiratory tract infections, antitussives are no better than placebos. Systematic reviews have also found that antitussives are not effective in coughs associated with whooping cough.

Q. Which of the following statements is INCORRECT:

A. Diphenhydramine is an expectorant

Response Feedback:

Diphenhydramine is a first generation antihistamine and not an expectorant

Please make sure that you know all the medications listed in these choices. (Oxymetazoline, Dextromethorphan, Pseudoephedrine, Diphenhydramine)

Q. A person with sinus pressure and pain related to a seasonal rhinitis would benefit from taking:

A. a decongestant

Response Feedback:

A person with sinus pressure and pain related to a seasonal rhinitis would benefit from taking a decongestant (and often times an antihistamine). The majority of decongestants act by enhancing adrenaline or adrenergic activity by stimulating the alpha- adrenergic receptors. This induces vasoconstriction of the blood vessels in the nose, throat, and para nasal sinuses, which reduces inflammation and mucus formation in those areas. Most nasal decongestants are contraindicated in patients taking MAOI antidepressants.

An expectorant (from the Latin expectorare, to expel from the chest) works by signalling the body to increase the amount or hydration of secretions, resulting in more yet clearer secretions and as a by-product lubricating the irritated respiratory tract. The most common example of an expectorant is guaifenesin.

A mucolytic agent is an agent, which dissolves thick mucus and is usually used to help relieve respiratory difficulties. It does so by dissolving various chemical bonds within secretions, which in turn can lower the viscosity by altering the mucin-containing components. Acetylcysteine and bromhexine are mucolytic agents.

An antitussive simply means that it is a cough medicine.

Another question could involve the definition of the terms in bold above or the following.

Nasal decongestants are contraindicated in patients taking:

A) antihistamines

B) certain types of antidepressants

C) antitussive agents

D) salicylate preparations

Answer: B

Question: I still don't get the difference between a mucolytic agent and an expectorant?

Answer: Think of them as getting to about the same place taking a different route:

An expectorant increases the amount of the patient's own secretions, resulting in more yet clearer secretions

A mucolytic agent dissolves thick mucus by dissolving the chemical bonds within the secretions

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Q. A person who coughs is usually experiencing a reflex caused by:

A. irritation to receptors in the trachea and conducting airways

Response Feedback:

The cough reflex is normally triggered by irritation to receptors in the trachea, main carina, branching points of large airways, and more distal smaller airways; however, cough receptors are also present in the pharynx. Laryngeal and tracheobronchial receptors respond to both mechanical and chemical stimuli. (Chemical receptors are sensitive to acid and heat).

In addition, more airway receptors are in the external auditory canals, eardrums, paranasal sinuses, pharynx, diaphragm, pleura, pericardium, and stomach. These are probably mechanical receptors only, which can be stimulated by triggers such as touch or displacement.

We only call a medicine "cough medicine" if it actually suppresses the cough. Some medicines like expectorants or mucolytic agents help with certain types of cough by helping remove the mucus that is resting on the cough receptor.

Q. A person with COPD that was caused by smoking would be expected to have:

A. loss of protective respiratory mechanisms due to prolonged irritation or damage

Response Feedback:

The term Chronic Obstructive Pulmonary Disease (COPD) includes individuals with predominantly chronic bronchitis and predominantly chronic emphysema. In either case, the normal lung defences are decreased because of increased secretions or decreased force of expiration. This predisposes the person to a decrease in the ability to expel toxins and microorganisms.

Q. A medication that is specifically marketed to people with cystic fibrosis is:

A. Dornase alpha

Response Feedback:

Cystic fibrosis is a relatively common genetic disorder that results in very thick secretions. One of the treatments for cystic fibrosis is a very expensive mucolytic agent called dornase alpha (discussed briefly in the upper respiratory disorder medications)

Q. Treatment of obstructive pulmonary disorders like asthma or chronic bronchitis is aimed at:

A. opening the conducting airways and/or decreasing the effects of inflammation

Response Feedback:

The three most common obstructive disorders are emphysema, chronic bronchitis and chronic asthma. In each, ventilation (bulk flow of air) is affected more than respiration (the exchange of gases at the alveoli). Therefore, these disorders often respond to opening airways and/or decreasing inflammation or the effects of inflammation.

Q. Which one of the following respiratory illnesses affects approximately 10% of adult Australians?

A. Bronchial asthma

Response Feedback:

It is estimated that 10% of Australians are affected by asthma. About 3-4% are affected by chronic bronchitis and/or emphysema. Cystic fibrosis is an autosomal recessive genetic disorder, and although common for a genetic disorder, affects less than 1% of Australians.

The term COPD is often used incorrectly. A classic example is found in the Asthma Australia website, as they define COPD as including asthma in their first paragraph of their introduction and later give differences between COPD and asthma. The reason for this blur is that the term COPD means chronic obstructive pulmonary disorder, and all three (asthma, emphysema, chronic bronchitis) do that (chronically obstruct the airways).

HOWEVER, for this unit and most likely in the profession you enter into, the term COPD should not be used for asthma. COPD is a disorder that includes emphysema and/or chronic bronchitis. Usually, a person with one of those two disorders progresses to having aspects of the other disorder.

Most individuals with COPD develop the disorder from chronic insult (smoking being the most common insult), although there is a subset of individuals with genetically acquired emphysema.

Asthma on the other hand is primarily induced by exaggerated immune system release of chemical mediators into the lung in response to internal and/or external factors. When working with a patient with asthma, the health professional should think of their disorder as being a cup that expresses the signs and symptoms of asthma only when it overflows. For instance, if we can help the patient reduce stress, decrease exposure to some antigens, and decrease exposure to smoke while we use the pharmaceutical agents to reduce the immune system response, the cup may not overflow. Conversely, if just one of those had been eliminated from the therapy program, the cup would have overflowed (the signs and symptoms of asthma would have been expressed)

Asthma is characterised by:

A) an autonomic nervous system imbalance

B) a tendency to develop in older individuals

C) the release of chemical mediators from immune cells in lung tissue

D) the dominance of the parasympathetic stimulation of the airways

Answer can be found within feedback

Q. A person with hypertension and known heart disease has frequent bronchospasms and asthma attacks that are most responsive to sympathomimetic drugs. This person might be best treated with:

A. an inhaled sympathomimetic like salbutamol

Response Feedback:

Please ensure that you know why this answer is correct...

Two of the ways to dilate the airways in a person with an obstructive disorder are to:

use a sympathomimetic (a drug that mimics the sympathetic nervous system, or mimics the actions of adrenaline)

use a parasympathetic nervous system blocker (an anticholinergic drug)

We said that the patient was most responsive to the sympathomimetic, so you would not use the anticholinergic drug (cross that one out).

The person also has hypertension so that patient would be sensitive to the systemic effects of sympathomimetics (a drug that mimics the sympathetic nervous system, resulting in increased heart rate, and greater blood pressure). Xanthines have widespread systemic effects, and are therefore contraindicated in the person. The inhaled sympathomimetics are β2 adrenergic agonists, or in other words are fairly selective for opening up the airways and they are also delivered directly to the lungs. So while some of the bronchodilator medicine gets into the system, it is very little and has very little affinity for the receptors that increase blood pressure.

Q. A medication that can be used in infantile apnoea is:

A. one of the xanthines (methylxanthines) like theophylline or aminophylline

Response Feedback:

*Another infant respiratory disorder is IRDS. In the treatment of Infant Respiratory Distress Syndrome (IRDS)**, surfactant needs to be instilled into an endotracheal tube properly placed in the baby's lungs.*

IRDS begins shortly after birth and is manifest by rapid breathing (tachypnoea), tachycardia, expiratory grunting, nasal flaring and cyanosis.

Despite huge advances in care, IRDS remains the most common single cause of death in the first month of life in the developed world.

***Infant respiratory distress syndrome (IRDS), also called neonatal respiratory distress syndrome, respiratory distress syndrome of newborn, or increasingly surfactant deficiency disorder (SDD), and previously called hyaline membrane disease (HMD), is a syndrome in premature infants who have not begun the production of their own surfactant.*

Q. A medication / medications that can be inhaled and will decrease most portions of the immune system in the lungs include:

A. Budesonide or fluticasone

Response Feedback:

Zafirlukast and montelukast are oral medications that block the leukotriene receptors

Aminophylline and theophylline are theophyllines that do some immune modulation but very little in comparison to the corticosteroids

Prednisone is an oral corticosteroid, but does decrease almost all arms of the immune system.

Budesonide and fluticasone are inhaled corticosteroids that decrease most immune responses.

*Inadequate response to inhaled corticosteroids is not infrequent during exacerbations of asthma. The most common causes are non-compliance or a delay in starting corticosteroid therapy**. These can be addressed by education and preparing an asthma action plan. Another cause of inadequate response is the presence of mucus plugging. There may be a slow response to therapy if mucus plugs are present. Therefore, if the person complains that the treatment is not successful, suggest they remain on the treatment for 3 weeks.*

***Inhaled corticosteroids should be included in the medication regime for asthma if the person is using their β2 agonist 'rescue remedy' like salbutamol more than three to four times per week. Think of what is happening when they are reaching for that medication. Each time an asthmatic reaches for their quick acting bronchodilator, they are having an acute asthmatic attack.*

Q. Dornase alfa (Pulmozyme), because of its mechanism of action, is reserved for use in:

A. relieving the build up of secretions in cystic fibrosis

Response Feedback:

Cystic fibrosis is a genetic disorder (autosomal recessive) that results in very thick secretions affecting the lungs, pancreas, and virtually any organ with secretions.

Dornase alfa is a highly purified solution of an enzyme which selectively cleaves DNA. Dornase alfa hydrolyzes the DNA present in sputum/mucus of cystic fibrosis patients and reduces viscosity in the lungs, promoting improved clearance of secretions.

Q. A client comes to you after taking both codeine and dextromethorphan for her cough. She appears to have respiratory depression consistent with opioid overdose. What is the name of the medication that will be given to her to reverse the actions of the opioids?

A. Naloxone

Response Feedback:

Naloxone is used in opioid overdoses. All of the other drugs listed in the choices are inhaled corticosteroids. The client should be placed in a semi-upright position (Fowler's position) until emergency services arrive.

Q. Leukotriene receptor antagonists like zafirlukast and montelukast are most beneficial in treating:

A. asthma

Response Feedback:

Leukotrienes are a family of inflammatory mediators produced by mast cells and leukocytes. In an asthmatic response, there is an immediate short-term reaction that is due to the release of histamine and a later, more prolonged response caused by leukotrienes. One of their roles is to trigger contractions in the smooth muscles lining the bronchioles.

Leukotriene antagonists can be used to treat asthma by blocking the actions of leukotrienes at the receptor on target cells such as bronchial smooth muscle.

Remember that the triggers for an asthmatic attack are different in each person. It therefore stands to reason that some patients will respond to one therapy best, while another patient will not respond to that therapy well at all. It may take some time to find the ideal therapy or combination of therapies most suited to each patient.

Q. One of the actions of the xanthines like aminophylline, theophylline and other '...phylline' drugs includes to:

A. stimulate the sympathetic nervous system

Response Feedback:

Xanthines are a group of alkaloids used as mild stimulants and as bronchodilators, especially in the treatment of asthma. Xanthines stimulate the respiratory centre, and are used for treatment of infantile apnoea. Due to widespread effects, the therapeutic range of xanthines is narrow, making them merely a second-line asthma treatment. Signs of toxicity include tremor, nausea, nervousness, and

tachycardia/arrhythmia. To recall the adverse effects of the the xanthines, remember that caffeine is a weak xanthine.

Nicotine stimulates liver metabolism of theophylline so this could be a question that is asked:

A person has been maintained on theophylline for many years and has recently taken up smoking. The theophylline levels in this person would be expected to:

Correct answer: fall, because the nicotine stimulates liver metabolism of theophylline

MULTIPLE CHOICE QUESTIONS AND ANSWERS

WEEK 03

Q. Once a postganglionic receptor site has been stimulated, the neurotransmitter must be broken down immediately. The sympathetic system breaks down postganglionic neurotransmitters by using:

A. COMT and MAO

Response Feedback:

Once a postganglionic receptor site has been stimulated, the neurotransmitter must be broken down immediately. The sympathetic system breaks down postganglionic neurotransmitters by using COMT and MAO. The parasympathetic system uses Acetyl cholinesterase.*

**Postganglionic receptor - in the autonomic nervous system, there are two neurons. The fibres from the ganglion (the group of cell bodies in between these two neurons) to the effector organ (such as the heart) are called postganglionic fibres. The neurotransmitter that the second neuron uses to affect the effector is noradrenaline in the sympathetic nervous system and acetylcholine in the parasympathetic system.*

Example of another question:

The neurotransmitter(s) used in the parasympathetic nervous system is (are):

A) noradrenaline and acetylcholine

B) acetylcholine

C) noradrenaline

D) dopamine

Answer: B

Q. Selective stimulation to the Beta 2 receptors of the sympathetic nervous system would result in which of the following?

A. Bronchodilation

Response Feedback:

Selectivity refers to a drug's ability to preferentially produce a particular effect and is related to the structural specificity of drug binding to receptors. For example, propranolol (a β-blocker) binds equally well to β1- and β2-adrenoceptors; metoprolol (a cardioselective β-blocker) binds selectively to β1-adrenoceptors; and salbutamol (a β-agonist used to open up airways in asthmatics) binds selectively to β2-adrenoceptors.

The selectivity of salbutamol may be further enhanced by administering it directly to the lungs. Selective stimulation of the Beta 2 receptors in the sympathetic nervous system would result in bronchodilation due to their presence in the lungs. Beta 2 receptors are also located in the mast cells, the uterus, and skeletal muscles, resulting in decreased release of histamine, and RELAXATION of the uterus. (Selective stimulation of Beta 2 receptors can have a slight effect on raising heart rate and contractility but in this group of answers, bronchodilation is definitely the best choice.)

Receptor selectivity in adrenergic agonists is desirable as potentially unwanted effects caused by stimulation of additional receptors are minimised. However, despite 'selective' stimulation, Beta 2 agonists will have a mild effect on other sympathetic nervous system receptors, potentially leading to an increased heart rate (especially with high doses), but the predominant effect is on the Beta 2 receptors.

The following is another question that could be asked about Beta 2 receptor agonists:

Which of the following drugs would be recommended to relieve acute symptoms of asthma?

A) Muscarinic agonist carbachol, because it constricts bronchioles and increases mucus secretion

B) Nicotinic antagonist atracurium, because it relaxes skeletal muscles

C) Selective β2 agonist salbutamol, because it dilates bronchioles

D) β antagonist sotalol, because it constricts bronchioles

Answer: C

Example of a question derived from the feedback:

Receptor selectivity in adrenergic agonists is desirable as:

A) potentially unwanted effects caused by stimulation of additional receptors are minimised

B) these medications always have fewer side effects on patients

C) there is a broader range of medications for prescribers to choose from

D) patients like to choose their own prescriptions

Answer: A

Q. When describing the functions of the autonomic nervous system, one includes:

A. Regulation of integrated internal body functions

Response Feedback:

The autonomic nervous system is the involuntary subconscious motor component of the peripheral nervous system and does not maintain body posture, balance, or special senses. The autonomic nervous system (ANS) functions include controlling the action of involuntary organs and tissues. The ANS regulates the secretion of products from glands, the rate and force of contraction of heart muscle, and the contraction and relaxation of smooth muscle, bronchioles, blood vessels and the gastrointestinal tract.

Example of a question derived from the feedback:

The involuntary subconscious motor component of the peripheral nervous system is called the:

A) autonomic nervous system

B) somatic nervous system

C) afferent nervous system

D) brain

Answer: A

Q. Stimulation of the parasympathetic nervous system would cause:

A. Slower heart rate and increased GI secretions

Response Feedback:

Indeed, stimulation of the parasympathetic nervous system would cause slower heart rate and increased GI secretions. It would also cause peripheral vasodilation, pupil constriction and bronchial constriction.

Q. In most situations, the parasympathetic nervous system opposes the actions of the sympathetic nervous system, allowing the autonomic nervous system to:

A. Maintain a fine control over internal homeostasis

Response Feedback:

In most situations, the parasympathetic nervous system opposes the actions of the sympathetic nervous system, allowing the autonomic nervous system to maintain a fine control over internal homeostasis. Simplistically put, this allows one portion of the ANS to put the brakes on when the other portion is accelerating.

Q. Cholinergic neurons use the following neurotransmitter:

A. Acetylcholine

Response Feedback:

Cholinergic neurons use the neurotransmitters acetylcholine in the muscarinic receptors. Since it acts on the muscarinic receptors, cholinergic and anticholinergic agents are often referred to as muscarinic and antimuscarinic agents respectively.

Q. If the Alpha 1 receptors in the sympathetic nervous system were selectively stimulated, which of the following would occur?

A. Vasoconstriction

Response Feedback:

*If the Alpha 1 receptors in the sympathetic nervous system were selectively stimulated, vasoconstriction of the periphery** would occur. Locations of other Alpha 1 receptors include the pupils (dilation), urinary bladder (urinary retention), uterus (contraction of the non-pregnant uterus) and sweat glands (sweating).*

*Advanced note: **The use of the word 'periphery' in this context refers to the skin, GIT, small muscles of the legs, and extremities. Some vessels such as the coronary artery and arteries to the large muscles actually end up dilating during a fight or flight response. Why? The constricting effects are offset by the dilating effects of nitric oxide released locally when Beta 2 receptors are stimulated. But remember that the predominant effect is vasoconstriction.*

An alternate version of the question could be:

A drug group that produces pupil dilation, increased blood pressure, urinary retention and constipation is likely to be the:

A) β1-blockers

B) α2 antagonists

C) β2 agonists

D) α1 agonists

Answer: D

Q. In an individual who is experiencing a very stressful experience that requires the sympathetic stress reaction, you would expect to find:

A. Dilated pupils and elevated systolic blood pressure

Response Feedback:

In a patient who is experiencing a very stressful experience that requires the sympathetic stress reaction, you would expect to find dilated pupils and increased blood pressure. Other signs and symptoms of this SNS response would include increased heart rate, decreased urination, dry mouth and digestive system complaints (due to the slowing of the digestive system functions).

Q. The autonomic nervous system differs from the other portion of the Peripheral Nervous System (PNS) in that it:

A. Affects organs and muscles by a two neuron system

Response Feedback:

The autonomic nervous system differs from the other portion of the Peripheral Nervous System (PNS) in that it uses a two neuron system. Central nervous system (CNS) cells that originate impulses are located in the spinal cord. These cells send out preganglionic fibres that synapse with nerve ganglia. The neurotransmitters released at the ganglia of the parasympathetic nervous system are nicotine (nicotinic receptors) or acetylcholine (muscarinic receptors).

Q. Phenylephrine is:

A. an alpha 1-selective agonist found in cold and allergy preparations

Response Feedback:

Phenylephrine is an alpha 1-selective agonist found in cold and allergy preparations can result in cardiac arrhythmias and difficulty urinating. It can also cause pupil dilation (not constriction) and can increase blood pressure. Recall the Alpha 1 receptors are located in blood vessels, the sphincters of the bladder and the pupil.

Phenylephrine is not the exact same drug as ephedrine. Ephedrine is a sympathomimetic amine used as a stimulant, appetite suppressant, decongestant and to treat hypotension associated with anaesthesia. Ephedrines work by a mixed action of releasing noradrenaline and direct agonist activity.

The herb má huáng (麻黄, Ephedra sinica), used in Chinese traditional medicine contains ephedrine and pseudoephedrine.

The following is an example of a question from the feedback:

Which one of the following statements best describes the actions of the ephedrines?

A) These drugs directly activate adrenergic receptor populations

B) These drugs are pro-drugs of adrenaline

C) These drugs trigger the release of presynaptic stores of noradrenaline

D) These drugs work by a mixed action of releasing noradrenaline and direct agonist activity

Answer: D

Can you name one drug that matches the description in each of the choices above? You will not be able to give an example of a beta 2 antagonist because remember what adrenaline does at the beta 2 receptor - it dilates the airways. So a beta 2 antagonist would pretty much just constrict the bronchi and there are no clinical applications for a drug like that. But please remember that dobutamine is the Beta 1 agonist and salbutamol is an example of the beta 2 agonist.

Q. Adrenergic agonists have which of the following effects on the heart?

A. Positive chronotropic and positive inotropic effects

Response Feedback:

Recall that adrenergic agonists increase the heart rate (positive chronotropic effect) and increase the contractility (positive inotropic effect).

In other words, adrenergic agonists have positive chronotropic and positive inotropic effects, meaning that hasten the heartbeat over time (chrono = time) and increase the force of the heart contractions (inos = fibre).

An example of an adrenergic agonist is dobutamine. It is used in acute heart failure.

Using these terms, what would you consider an agent that decreases the contraction of the heart but has no effect on the heart rate?

Q. Which of the following adrenergic agents would be most suitable for treating signs and symptoms of allergic rhinitis?

A. Phenylephrine

Response Feedback:

The adrenergic agent would be most suitable for treating the signs and symptoms of allergic rhinitis is phenylephrine, a selective Alpha 1 adrenergic receptor agonist. It is also used to dilate the pupils and increase blood pressure. (Recall that the Alpha 1 receptors are located in the blood vessels and in the eye).

Dobutamine is a selective Beta 1 sympathomimetic drug used in the treatment of heart failure (recall the location of the Beta 1 receptors in the heart, GIT and kidneys). Noradrenaline is a non-selective drug, used to treat dangerously low blood pressure. Dopamine is a neurotransmitter in the brain that is altered in Parkinson's disease, but does not cross the blood brain barrier so is not used in the treatment of that disorder.

Q. Over the counter cold and flu remedies that contain phenylephrine, an Alpha selective agonist, is contraindicated in which of the following?

A. Thyroid or cardiovascular disease

Response Feedback:

Over the counter cold and flu remedies that contain phenylephrine, an alpha selective agonist, are contraindicated in heart and thyroid disease. The selective Alpha 1 agonist may be slightly beneficial in people with hypotension, COPD, and runny nose due to its potential to increase heart rate, dilate the bronchi, and constrict the nasal blood vessels. The thyroid hormones T3 and T4 increase the actions of catecholamines. Sympathomimetics like phenylephrine can cause dysrhythmias in people with thyroid or heart problems.

Q. Which adrenergic agent would be most suitable in an intravenous administration for anaphylactic shock?

A. A non-selective agonist like adrenaline

Response Feedback:

The adrenergic agent that would be most suitable in an intravenous administration for anaphylactic shock is adrenaline. Adrenaline acts like the the natural adrenaline in our systems, hitting the alpha 1 receptors (constriction of blood vessels), hitting the beta 1 receptors (increased heart rate) and hitting the beta 2 receptors (opens up the lungs) Adrenaline is the drug of choice for treating anaphylaxis rather than the less constricting noradrenaline or the selective alpha and beta adrenergic agonists.

In anaphylactic shock, basophils and mast cells all throughout the body are releasing histamine. Adrenaline counteracts the vasodilation and bronchoconstriction caused by histamine, and increases heart rate and contractility, making up for the fact that fluid has escaped from the blood vessels into the interstitial spaces (histamine also increases vascular permeability leading to this oedema).

You should attempt to know a bit about each of the drug classes/drugs listed in the choices (read Bullock or use another source).

Q. Adrenergic drugs are also known as:

A. Sympathomimetic agents

Response Feedback:

Receptors that respond to noradrenaline are called adrenergic. Adrenergic drugs are also known as sympathoMIMETICS, because they mimic the sympathetic nervous system response. It is important that you know every term used to describe these drugs; otherwise the term you read the next time may be different from the term with which you are familiar. Receptors that respond to acetylcholine (ACh) are calledcholinergic.

Example of a question from the feedback:

Receptors that respond to noradrenaline are called:

A) adrenergic

B) cholinergic

C) dopaminergic

D) noradrenergic

Answer: A

Q. After intravenous administration of an adrenergic agent for treatment of shock, the following should be done:

A. Remove the IV and prepare for administration of phentolamine to the area

Response Feedback:

After intravenous administration of an adrenergic agent for the treatment of shock, one should remove the IV and prepare for administration of phentolamine to the area. Phentolamine (Regitine) is a reversible, non-selective Alpha-adrenergic antagonist.

That means that the phentolamine does the exact opposite thing that adrenaline does, but it is applied only to the injection site in this instance, (or systemically in the case of adrenaline overdose). Recall that the Alpha 1 receptors control the tone of the blood vessels. Blocking these effects locally will help prevent necrosis of the tissue at the injection site.

Q. Adverse effects associated with the adrenergic agonists include:

A. Hypertension

Response Feedback:

Adverse effects associated with the adrenergic agonists include hypertension. Recall that adrenergic agonists (1) constrict peripheral blood vessels (alpha 1 receptors), (2) increase heart rate (beta 1 receptor) and (3) increase heart contractility (beta 1 receptor). Therefore there are at least three mechanisms by which sympathomimetics (adrenergic agents; adrenergic agonists) can cause hypertension.

Q. Common adverse effects of β1 agonists include:

A. increased blood pressure, tachycardia and constipation

Response Feedback:

Beta-adrenergic agonists are a class of sympathomimetic agents which act upon the beta adrenoceptors and are used in hypotension and some (mostly acute) forms of heart failure. Recall the location of the beta receptors (beta1 is mostly heart, beta 2 is mostly in the lungs).

So, activation of β1 receptors induces positive inotropic, positive chronotropic output of the cardiac muscle, leading to increased heart rate and blood pressure. Activation of β2 receptors induces smooth muscle relaxation in the lungs, gastrointestinal tract, and uterus.

Q. Phentolamine (Regitine), an Alpha-adrenergic blocker is frequently used:

A. To treat hypertensive emergencies and as a local agent to increase blood supply to an area

Response Feedback:

Phentolamine (Regitine), an Alpha-adrenergic blocker, is most frequently used to prevent cell death after extravasation of intravenous dopamine or noradrenaline. It is also used in some cases of hypertensive emergency due to its vasodilating effects. Recall that the Alpha 1 receptor is found mostly on peripheral blood vessels. BLOCKING the SNS innervation would result in less tone and more relaxation in these vessels.

The Alpha-adrenergic blockers are contraindicated in pregnancy, cardiac arrhythmias and in people with hypersensitivities.

Q. The Beta blocker of choice for a person who is hypertensive and has angina is:

A. Timolol

Response Feedback:

Indeed, the Beta blocker of choice for a person who is hypertensive and has angina is currently timolol. Propranolol was the first of this class, but it crosses the blood brain barrier and has many more side effects than timolol.

Another question about beta blockers is as follows:

A clinical use for β antagonists is in the treatment of:

A) bronchial asthma

B) hypotension

C) hypertension

D) nasal decongestion

Answer: C

This is an important drug group! When we discuss the cardiovascular medications, please read what Bullock says or seek another source.

Q. You would NOT give a selective Beta 1 antagonist to a person who has:

A. cardiogenic shock

Response Feedback:

You would NOT give a selective Beta 1 antagonist to a person who is susceptible to hypersensitivity reactions, heart block, cardiogenic shock, hypotension or who is pregnant.

Q. Individuals taking adrenergic blockers are instructed to:

A. Never to stop the drug abruptly

Response Feedback:

Patients taking adrenergic blockers are instructed to avoid stopping the drugs suddenly. All of the adrenergic blocking drugs must be tapered off slowly when they are discontinued after long-term use. The receptors become hypersensitive to catecholamines, and not tapering can result in extreme hypertension, angina, stroke and/or myocardial infarction.

An example of a question from the feedback is as follows:

Clients on an α receptor blocking agent should be advised not to stop taking the medication abruptly if they experience problems, because this may lead to all of the following except:

A) rebound hypertension

B) angina attacks

C) rebound tachycardia

D) severe depression

Answer: D

Q. Another term for adrenergic blocking drugs is:

A. Sympatholytics

Response Feedback:

Another term for adrenergic blocking drugs is sympatholytics. Sympathetic antagonists, Beta blockers, Alpha antagonists, cardiac specific SNS antagonists, and other similar terms will be used by various authors.

Q. An adverse effect of a beta blocker can be:

A. hypotension or orthostatic hypotension

Response Feedback:

Hypotension or orthostatic hypotension is a potential side effect of the drugs that block the actions of adrenaline.

Another question that could be asked is:

The way to determine the effect of a sympatholytic agent on postural hypotension is to measure:

- *lying blood pressure only*
- *standing blood pressure only*
- *sitting blood pressure only*
- *lying and standing blood pressures*

Postural hypotension (or orthostatic hypotension) can be caused by beta blockers (sympatholytic agents). Postural hypotension is defined as a drop in systolic blood pressure of at least 20 mm Hg or diastolic blood pressure of at least 10 mm Hg when a person assumes a standing position. In reality though, if your patient gets dizzy or lightheaded without reaching the figures above, there is a danger of the patient falling and that patient should be considered to have postural hypotension.

Normally, as one stands from a seated position, gravity pulls the blood down, but the sympathetic nervous system immediately raises the blood pressure to prevent cerebral hypoxia (decreased oxygen to the brain). A healthy person therefore often has a few mm Hg increase in pressure when standing, while a person on beta blockers loses some of this effect.

Q. Which of the following conditions would warrant administration of drugs like labetalol or carvedilol which block all adrenergic receptor sites?

A. Cardiovascular conditions like hypertension and congestive heart failure

Response Feedback:

Drugs like labetalol carvedilol and amiodarone, which block all adrenergic receptor sites are used for a variety of cardiac related illnesses including hypertension, heart failure and as an anti-arrhythmic drug. Labetalol is particularly useful in pre-eclampsia, which is a pregnancy induced hypertension.

These drugs are contraindicated in individuals with known hypersensitivities and bronchospasm.

Q. Selective Alpha 1 adrenergic blocking agents like prazosin and other ...osin drugs are most likely to be used in a person with which of the following conditions?

A. Hypertension and benign prostatic hyperplasia

Response Feedback:

Selective Alpha 1 adrenergic blocking agents are most likely to be used in a person with hypertension and benign prostatic hyperplasia. This is due to the presence of Alpha 1 receptors in the peripheral blood vessels and in the prostate.

Q. A person who is suspected of having COPD and is being treated with a Beta-blocker is most likely to receive:

A. A Beta 1 specific blocker

Response Feedback:

A person who is suspected of having COPD and is being treated with a Beta-blocker is most likely to receive a Beta 1 adrenergic blocking drug.

Beta 1 selective sympatholytics like atenolol and metoprolol do not block the Beta 2 receptors that are responsible for bronchodilation and are therefore preferred for people with respiratory problems.

Beta 2 receptors in the lung, on the other hand, are responsible for bronchodilation when stimulated, and blocking these does not allow the bronchodilation needed in respiratory illnesses.

Another question I could ask about Beta 1 blockers is as follows:

A drug group that produces decreases in heart rate and blood pressure, as well as increases in gastrointestinal motility, is likely to be the:

A) α1 agonists.

B) β2 agonists.

C) α1 antagonists.

D) β1-blockers.

Answer: D

Q. In the information session given with anticholinergic agents like hyoscine and atropine, the patient should be told to:

A. All of the suggestions given as potential answers are appropriate

- Use sugarless lozenges to relieve the dry mouth that occurs
- Set a bowel program in place to deal with constipation
- Void before dosing

Response Feedback:

In the information session given with anticholinergic agents, the patient should be told to use sugarless lozenges to combat dry mouth. The practitioner should also recommend a high fibre, high water diet to alleviate digestive discomfort, and recommend voiding before taking the medicine, as it causes urinary retention in some people. Remember that increasing insoluble fibre without increasing water consumption can in itself cause rather than relieve constipation.

Q. One of the hallmarks of Alzheimer's disease is a progressive:

A. Loss of acetylcholine-producing neurons and their target neurons in the CNS

Response Feedback:

One of the hallmarks of Alzheimer's disease is a progressive loss of acetylcholine-producing neurons and their target neurons in the CNS. Indirect acting cholinergic agonists such as galantamine are used in the management of Alzheimer's dementia.

Parkinson's disease is a degeneration of dopamine producing cells in the basal ganglia.

Myasthenia gravis is a loss of acetylcholine receptor sites in the neuromuscular junction.

Q. Hyoscine is an acetylcholine antagonist and as such is used for:

A. Reliving gastrointestinal spasms and motion sickness

Response Feedback:

Hyoscine is an antagonist of acetylcholine which is the neurotransmitter of the rest and digest system, so it antagonizes the rest and digest system. Therefore Hyoscine in effect, works by putting the brakes on the rest and digest system. It is therefore good for decreasing GIT spasm.

One of the neurotransmitters involved in the transmission of the impulses from the vestibular nerve to the vomiting center is acetylcholine, hence the benefits of hyoscine in people with motion sickness.

Common adverse reactions of muscarinic antagonists include drowsiness, tachycardia, constipation, blurred vision, dry mouth and facial flushing.

Long term use of acetylcholine antagonists is associated with increased risk of developing Alzheimer's disease.

Q. When administering an acetylcholinesterase inhibitor (example: neostigmine (for myasthenia gravis) and donepezil (for Alzheimer's disease)), there is a possibility of a cholinergic crisis (overdose of acetylCHOLine). The symptoms of a cholinergic crisis include which of the following:

A. muscle weakness, increased salivation and diarrhoea

Response Feedback:

When administering an acetylcholinesterase inhibitor there is a possibility of a cholinergic crisis (overdose; muscle weakness, increased salivation and diarrhoea). If this occurs, it can be reversed with the administration of atropine.

Atropine counters the "rest and digest" activity of glands regulated by the parasympathetic nervous system. This occurs because atropine is a competitive antagonist of the muscarinic acetylcholine receptors. Atropine dilates the pupils, increases heart rate, and reduces salivation and other secretions.

The following is another example of a question about acetylcholinesterase inhibitors:

When administering an acetylcholinesterase inhibitor, which of the following drugs should be kept on hand to reverse muscular weakness associated with an overdose?

A) Cholinergic receptor stimulation

B) Suxamethonium

C) Tubocurarine

D) Atropine

Answer: D

Q. Cholinergic drugs (the ones that work like acetylCHOLine, the main neurotransmitter of the parasympathetic nervous system) are associated with which of the following groups of adverse effects?

A. Diarrhoea and urinary urgency

Response Feedback:

Cholinergic drugs are related to the stimulation of the parasympathetic nervous system, the rest and DIGEST system. Digestive effects include nausea, vomiting, cramps, diarrhoea, increased salivation and faecal incontinence. Cardiovascular effects can include bradycardia, heart block and hypotension. Urinary tract effects can include a sense of urgency.

Cholinergic drugs can be direct acting that act like acetylcholine (example: pilocarpine) or indirect acting, that work against the breakdown of acetylcholine at the synaptic cleft (neostigmine and donepezil)

Q. The enzyme associated with degradation of the neurotransmitter at muscarinic receptors is:

A. acetylcholinesterase

Response Feedback:

The enzyme associated with inactivation of the acetylcholine (the muscarinic) neurotransmitter is acetylcholinesterase (AChE) .

Catechol-O-methyltransferase (COMT) and monoamine oxidase A (MAOA) degrade the catecholamines (dopamine, serotonin, melatonin, adrenaline and noradrenaline.

Q. Myasthenia gravis is treated with indirect acting cholinergic agents that:

A. Lead to accumulation of acetylcholine in the synaptic cleft

Response Feedback:

Myasthenia gravis is treated with indirect acting cholinergic agents like neostigmine that lead to accumulation of acetylcholine in the synaptic cleft.

In myasthenia gravis, autoantibodies destroy the receptor sites for acetylcholine (ACh). Neostigmine and other indirect cholinergic agonists prevent the breakdown of ACh in the synaptic cleft. The fewer remaining receptor sites have longer to take up the neurotransmitter ACh when these agents are administered.

Cholinergic agonists (direct or indirect) often result in diarrhoea and nausea.

The following is an example of a question from the feedback:

An expected response associated with direct or indirect cholinergic agonists would be:

A) sedation

B) mental confusion

C) diarrhoea and nausea

D) facial flushing

Answer: C

Q. Parasympathetic stimulation would result in which one of the following sets of responses?

A. Increased gastrointestinal motility, pupil constriction, defecation and erection of genitalia

Response Feedback:

Note that I could also say "muscarinic agonists may result in ...". The muscarinic receptors are those using acetylcholine as the neurotransmitter.

Q. Anticholinergic drugs like hyoscine and atropine are used:

A. To allow the sympathetic system to dominate

Response Feedback:

Anticholinergic drugs are used to allow the sympathetic system to dominate. Atropine, a commonly used anticholinergic agent, decreases GIT secretions, and is used in the treatment of bradycardia and urinary retention, and also to dilate the pupils.

An example of a question from the feedback is as follows:

Muscarinic antagonists (also known as acetylcholine antagonists, acetylcholine blocking agents, parasympatholytic drugs) are useful in the management of:

A) myasthenia gravis

B) glaucoma

C) tachycardia

D) urinary incontinence

Answer: D

Q. Donepezil is administered to a person with Alzheimer's disease who:

A. Has mild, moderate or severe dementia

Response Feedback:

Donepezil is administered to a person with severe Alzheimer's disease who cannot even remember family members' names. Other drugs in this class are for mild to moderate Alzheimer's disease.

Q. Pilocarpine, a direct acting cholinergic agonist, is administered to treat which of the following conditions?

A. Glaucoma

Response Feedback:

Pilocarpine, a direct acting cholinergic agonist, is administered to treat glaucoma and to increase secretions in people with a dry mouth. How do they work? Pilocarpine works like acetylcholine, the main neurotransmitter of the parasympathetic nervous system. The rest and digest system increases salivation and constricts the pupils of the eyes. When we are resting and digesting we need very little light but a lot of activity in the GIT.

Another way I can ask this is as follows:

Muscarinic agonists can be used in the management of:

A) tobacco dependence

B) glaucoma

C) bradycardia

D) peptic ulcer

Answer: B

Q. The antidote to nerve gas (irreversible acetylcholinesterase inhibitors) is:

(Note that there are two ways to answer this question correctly, to know (or guess) the correct drug, or to correctly hypothesise which action would reverse the action of nerve gas. This is a difficult question, but one that can extend your insight into pharmacodynamics.)

A. Atropine, a competitive antagonist of the muscarinic acetylcholine receptors

Response Feedback:

The antidote to a nerve gas that causes an irreversible acetylcholinesterase inhibition is atropine, a competitive antagonist of the muscarinic acetylcholine receptors.

Nerve gas ensures that ACh does not break down at the SNS and neuromuscular junctions. So in the presence of nerve gas, there are very high levels of ACh in the neuromuscular junction. If this was left untreated, it would result in excess contraction of all muscles, and respiratory failure. (we need to contract AND relax our respiratory muscles to breathe)

Atropine blocks the receptors for the ACh, so that the muscles do not respond to this excess amount of ACh.

Q. Indirect cholinergic agents (Donepezil. Neostigmine):

A. Enzymatically inhibit the enzyme acetylcholinesterase to increase acetylcholine concentrations

Response Feedback:

Indirect cholinergic agents inhibit acetylcholinesterase to increase acetylcholine concentrations.

Acetylcholinesterase is the enzyme that breaks down acetylcholine (ACh). Preventing ACh from doing it's job increases the level of ACh in the synaptic cleft. This results in increased stimulation of the cholinergic receptor sites.

Acetylcholinesterase inhibitors result in bronchoconstriction, increased GIT motility, pupil constriction, increased muscle tension and bradycardia

The following question is an example of a question from the feedback.

Which set of drug responses best matches the action of an acetylcholinesterase inhibitor?

A) Feelings of relaxation, increased skeletal muscle tone, increased autonomic tone and the release of catecholamines

B) Bronchoconstriction, increased gastrointestinal motility, pupil constriction, increased skeletal muscle tension and bradycardia

C) Tachycardia, facial flushing, decreased gastrointestinal motility, dry mouth and urinary retention

D) Tachycardia, histamine-induced hypotension, muscle relaxation and decreased gastrointestinal motility

Answer: B

Donepezil and Neostigmine are important drugs that you should read about or seek information from another resource

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Q. Anticholinergic agents reduce sweating. To reduce the risks associated with this, you would recommend:

A. Ensuring hydration and temperature control

Response Feedback:

Anticholinergic agents reduce sweating. To reduce the risks associated with this, you should recommend ensuring hydration and temperature control.

In humans, sweating is a means of thermoregulation. Evaporation of sweat from the skin surface has a cooling effect due to evaporative cooling. Animals with few sweat glands, such as dogs, undergo temperature regulation by panting and drinking plenty of water.

Q. How many subtypes of muscarinic receptors have been identified?

A. five

Response Feedback:

Five muscarinic (acetylcholine receptor) subsets have been identified:

M1 increases secretion from salivary glands and stomach

M2 slows heart rate, reduces contractile forces of atrium

M3 smooth muscle contraction, bronchoconstriction, increased endocrine and exocrine gland secretions, eye accommodation

M4 CNS

M5 CNS

MULTIPLE CHOICE QUESTIONS AND ANSWERS

WEEK 04

Q. An antimicrobial drug mechanism of action generally regarded as bacteriostatic is often one that:

A. interferes with metabolic processes

Response Feedback:

A bacteriostatic agent is an agent that stops bacteria from reproducing, while not necessarily harming them otherwise. Bacteriostatic agents can achieve this by interfering with bacterial protein production, DNA replication, or other aspects of bacterial cellular metabolism.

Q. What should a person be advised to do when taking sulfonamide therapy?

A. The patient should do everything listed in the choices for this MC question

- Have a full blood examination during high-dose or prolonged therapy
- Monitor folate status during high-dose or prolonged therapy
- Ensure an adequate fluid intake

Response Feedback:

Sulfonamides have the potential to cause a variety of untoward reactions, including urinary tract disorders, haemopoietic disorders, folate deficiency, hypersensitivity reactions and kidney damage. Hypersensitivity reactions include reactions against blood cells, so a full blood count should be performed. Sulfonamides are toxic to the kidneys so plenty of water should be consumed.

While drug monographs do not include this precaution, previous experience with combining nephrotoxic agents suggests that we: caution the patient against the use of analgesics that affect the kidneys while on sulfonamides. These include aspirin and NSAIDs.

Q. Which one of the following is not a common adverse effect of treatment with penicillin?

A. Photosensitivity

Response Feedback:

Common adverse drug effects associated with penicillin include rash, oedema, GIT complaints but not photosensitivity.

Q. During treatment with selected sulfonamides, a client may experience diarrhoea. This usually indicates:

A. a change in the balance of gut flora

Response Feedback:

Sulfonamides cause diarrhoea because they disrupt the bowel flora.

Q. Combination therapy is often used in treating infections. An important consideration for using combination therapy would be that:

A. the combination of drugs can delay the emergence of resistant strains

Response Feedback:

The combination of antibiotic drugs can delay the emergence of resistant strains. The idea behind combination therapy is to find two drugs that work by different mechanisms.

Different antibiotics have different mechanisms of action, owing to the nature of their structure and degree of affinity to certain target sites within bacterial cells. The following is a useful reference to have available, but it is not going to be tested in this unit:

Inhibitors of cell wall synthesis. While the cells of humans and animals do not have cell walls, this structure is critical for the life and survival of bacterial species. A drug that targets cell walls can therefore selectively kill or inhibit bacterial organisms. Examples: penicillins, cephalosporins, bacitracin and vancomycin.

Inhibitors of cell membrane function. Cell membranes are important barriers that segregate and regulate the intra- and extracellular flow of substances. A disruption or damage to this structure could result in leakage of important solutes essential for the cell's survival. Because this structure is found in both eukaryotic and prokaryotic cells, the action of this class of antibiotic is often poorly selective and can often be toxic for systemic use in the mammalian host. Most clinical usage is therefore limited to topical applications. Examples: polymixin B and colistin.

Inhibitors of protein synthesis. Enzymes and cellular structures are primarily made of proteins. Protein synthesis is an essential process necessary for the multiplication and survival of all bacterial cells. Several types of antibacterial agents target bacterial protein synthesis by binding to either the 30S or 50S subunits of the intracellular ribosomes. This activity then results in the disruption of the normal cellular metabolism of the bacteria, and consequently leads to the death of the organism or the inhibition of its growth and multiplication. Examples: Aminoglycosides, macrolides, lincosamides, streptogramins, chloramphenicol, tetracyclines.

Inhibitors of nucleic acid synthesis. DNA and RNA are keys to the replication of all living forms, including bacteria. Some antibiotics work by binding to components involved in the process of DNA or RNA synthesis, which causes interference with the normal cellular processes, which will ultimately compromise bacterial multiplication and survival. Examples: quinolones, metronidazole, and rifampin.

Inhibitors of other metabolic processes. Other antibiotics act on selected cellular processes essential for the survival of the bacterial pathogens. For example, both sulfonamides and trimethoprim disrupt the folic acid pathway, which is a necessary step for bacteria to produce precursors important for DNA synthesis. Sulfonamides target and bind to dihydropteroate synthase, trimethophrim inhibits dihydrofolate reductase; both of these enzymes are essential for the production of folic acid, a vitamin synthesized by bacteria, but not humans.

Q. Antibiotics are agents that are effective in controlling:

A. bacteria

Response Feedback:

The word antimicrobial was derived from the Greek words anti (against), mikros (little) and bios (life) and refers to all agents that act against microbial organisms. This is not synonymous with antibiotics, a similar term derived from the Greek word anti (against) and biotikos (concerning life).

By strict definition, the word "antibiotic" refers to substances produced by microorganisms that act against another microorganism. Thus, by strict definition, antibiotics do not include antimicrobial substances that are synthetic (sulfonamides and quinolones), semisynthetic (methicillin and amoxicillin), or those which come from plants (quercetin and alkaloids) or animals (lysozyme). Conversely, lay people commonly use the term antibiotic and antimicrobial or anti-infective interchangeably.

However most health professionals and pharmacology authors use the term antibiotic synonymously with the term anti-bacterial agent, and this is the definition we use in this unit

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Q. The spectrum of activity of an anti-infective indicates:

A. the anti-infective's effectiveness against different invading organisms

Response Feedback:

The spectrum of activity of an antibiotic indicates its effectiveness against different invading organisms.

Depending on the range of bacterial species susceptible to these agents, antibacterials are classified as broad-spectrum, intermediate-spectrum, or narrow- spectrum. Note that the spectra of activity may change with acquisition of resistance genes.

Q. Which drug group is considered a suitable alternative to penicillins when there is a known allergy?

A. The macrolides

Response Feedback:

The antimicrobial spectrum of macrolides is slightly wider than that of penicillin, and, therefore, macrolides are a common substitute for patients with a penicillin allergy.

Q. A broad-spectrum antibiotic would be the drug of choice when:

A. one is waiting for culture and sensitivity results

Response Feedback:

Broad-spectrum antibiotics are often used when it is not considered necessary to take a culture or while the culture is being assessed. After the microorganism has been identified and its sensitivity to various antibiotics has been determined, the individual could be placed on a different and often narrow spectrum antibiotic.

Broad-spectrum antibiotics act against a wide range of both gram-positive and gram-negative bacteria. Conversely, narrow-spectrum antibiotics are effective against specific families of bacteria. An example of a broad-spectrum antibiotic is ampicillin.

Q. To help prevent the emergence of resistant strains of microbes, healthcare workers should:

A. limit the use of antimicrobial agents to the treatment of specific pathogens known to be sensitive to the drug being used

Response Feedback:

To help prevent the emergence of resistant strains of microbes healthcare workers should limit the use of antimicrobial agents to the treatment of specific pathogens known to be sensitive to the drug being used.

Antibiotic resistance can be a result of horizontal gene transfer or point mutation in the genetic makeup of the bacteria. Those bacteria that develop a mutation that allows them to survive will live to reproduce and pass the mutation to their offspring, which leads to the evolution of a fully resistant colony.

Other things that can be done to reduce the emergence of resistant strains of microbes include limiting the use of antibiotics to those who need them, trying to ensure compliance and correct dosage and correct antibiotic for the microbes involved, and trying to ensure the individual prescribed uses the entire prescription rather than saving some for another infection.

Q. A superinfection is a second infection superimposed on an earlier one, especially by a different microbial agent of exogenous or endogenous origin, that is resistant to the treatment being used against the first infection. Superinfections can occur when anti-infective agents destroy the normal flora of the body. Candida infections are commonly associated with antibiotic use. A person with this type of superinfection would exhibit:

A. vaginal discharge or white patches in the mouth

Response Feedback:

A super-infection is a new infection occurring in a patient having a pre-existing infection. In the example given, Candida infections associated with antibiotic use would cause vaginal discharge and/or white patches in the mouth.

The normal flora consists of bacteria and fungi that live in harmony. Many of the products secreted from the bacteria keep the fungi in check and vice versa. (In fact, most of our early antibiotics, starting with penicillin, were derived from fungal toxins and some of our antifungal agents were derived from bacterial toxins.) Selectively destroying bacteria or fungi often gives rise to the other.

Q. Which of the following antimicrobial agents has a concentration or dose-dependent activity on microorganisms?

A. The aminoglycoside, gentamicin

Response Feedback:

Those antibiotics which eradicate pathogenic bacteria by achieving high dose (or concentration) at the site of binding are termed as concentration-dependent antibiotics. The aminoglycoside, gentamicin is an example of a concentration-dependent antibiotic.

Q. The definition of a prophylactic is a medication, treatment or instrument that is meant to prevent disease

An example of an anti-infective used as a means of prophylaxis would be:

A. an antibiotic used before dental surgery

Response Feedback:

The definition of a prophylactic is drug, treatment or instrument intended to prevent disease. More recently in North America, the word became commonly used to denote a condom.

Despite the use of sterile techniques, surgical procedures can induce bacteria into the blood of the patient, often leading to septicaemia. Between 5 to 10 percent of hospitalized patients undergoing surgery acquire a nosocomial (hospital acquired) infection adding an average of 4 extra days to the hospital stay.

Q. Sensitivity testing of a culture shows:

A. drugs that are capable of controlling that particular microorganism

Response Feedback:

Microscopy, culture and sensitivity (MC&S) is the full term used when sending microbiological samples to the laboratory.

Microscopy: The sample can be viewed under a microscope within minutes of arriving at the laboratory. This enables a quick initial report, such as 'Gram positive cocci seen', to be telephoned to the clinician if necessary. Combined with an accurate clinical picture, this may be enough to initiate targeted treatment.

Culture: A sample from the original culture is grown to create a pure sample to enable further identification of an organism.

Sensitivity: A pure culture is seeded onto an agar plate containing discs saturated with various antibiotics. If the organism grows up to a disc it is resistant to that antibiotic; if there is a clear zone around the disc, it is susceptible.

Q. Which one of the following statements is relevant regarding antimicrobial drugs that are time-dependent?

A. The period of time above the minimum effective concentration determines the effectiveness of treatment

Response Feedback:

Those classes of antibiotics whose killing response is dependent on time are termed as time-dependent antibiotics. Higher concentration of such drugs does not result in greater killing of organism, and only results in more side effects. Rather, the period of time above the minimum effective concentration determines the effectiveness of treatment.

Q. Ciprofloxacin (Ciprol), a widely used antibiotic, is an example of:

A. a fluoroquinolone

Response Feedback:

Ciprofloxacin (ciprol) is a fluoroquinolone that is indicated for the treatment of urinary tract infections, gonococcal urethritis and cervicitis, gastroenteritis, bronchial infections, bone and joint infections and chronic bacterial prostatitis. Most fluoroquinolones end in the suffix floxacin.

Q. Which of the following is safe to use on the skin:

A. antiseptic

Response Feedback:

An antiseptic is safe to use on the skin. Cetrimide is an antiseptic that has detergent properties. It is the best antiseptic for cleaning road-side accident wounds.

Cetrimide inhibits bacterial growth because of its _____ properties.

reducing

alkylating

detergent

oxidising

Q. An example of a sterilant is:

A. ethylene oxide

Response Feedback:

Ethylene oxide is an example of a sterilant or disinfectant.

Q. Antibiotics that are used together to increase their effectiveness and limit the associated adverse effects are said to be:

A. synergistic

Response Feedback:

Antibiotic synergism occurs when the effects of a combination of antibiotics is greater than the sum of the effects of the individual antibiotics. Antibiotic antagonism occurs when one antibiotic, usually the one with the least effect, interferes with the effects of another antibiotic.

Q. An aminoglycoside antibiotic might be the drug of choice in treating:

A. serious infection caused by susceptible strains of gram-negative bacteria

Response Feedback:

An aminoglycoside antibiotic might be the drug of choice in treating serious infection caused by susceptible strains of gram-negative bacteria.

Aminoglycosides are useful primarily in infections involving aerobic, Gram-negative bacteria such as Pseudomonas, Acinetobacter, Enterobacter and Mycobacteria (tuberculosis, leprosy). The most frequent use of aminoglycosides is empiric therapy for serious infections such as septicemia, complicated intra-abdominal infections, complicated urinary tract infections, and nosocomial (hospital acquired) respiratory tract infections. Usually, once cultures of the causal organism are grown and their susceptibilities tested, aminoglycosides are discontinued in favour of less toxic antibiotics.

Q. The penicillins:

A. are bactericidal, interfering with bacteria cell walls

Response Feedback:

Penicillins are bactericidal, killing bacteria by interfering with bacteria cell walls. They are normally used against gram-positive organisms.

Penicillin shows a synergistic effect with aminoglycosides, since the inhibition of peptidoglycan synthesis allows aminoglycosides to penetrate the bacterial cell wall more easily, allowing their disruption of bacterial protein synthesis within the cell.

Q. Tetracycline can:

A. tetracycline can do/cause all of the points listed in the choices

Response Feedback:

Tetracycline has many adverse effects. Please become familiar with the ones given in the questions because a similar question is likely to test your knowledge of those exact adverse effects.

Q. If a microbe has developed resistance to a certain antimicrobial preparation the prescriber should:

A. determine which antimicrobial the microbe may be sensitive to

Response Feedback:

If a microbe has developed resistance to the chosen therapy, it should be determined which antimicrobial agent it is sensitive to. This is done by performing another culture and sensitivity test.

A culture is done to find out what kind of organism (usually bacteria) is causing an illness or infection. A sensitivity test checks to see what kind of medicine, such as an antibiotic, will work best to treat the illness or infection.

Q. An example of an antiseptic is:

A. 70% alcohol, 6% hydrogen peroxide or cetrimide

Response Feedback:

Antiseptics are antimicrobials applied to skin to reduce the possibility of infection. Antiseptics are generally distinguished from antibiotics which destroy bacteria within the body; and from disinfectants, which destroy microorganisms found on non-living objects. An example of an antiseptic is cetrimide or an agent containing 70% alcohol, 6% hydrogen peroxide. Interestingly, 100% alcohol is very ineffective while 70% is fairly effective.

Cetrimide is an antiseptic which is a mixture of different quaternary ammonium salts including cetrimonium bromide

Q. A bacteriostatic substance is one that:

A. prevents the growth of specific bacteria that are sensitive to the substance

Response Feedback:

Antibacterial agents can be bactericidal agents that kill bacteria or bacteriostatic agents that slow down or stall the bacterial growth. Those that target the bacterial cell wall (penicillins and cephalosporins) or the cell membrane (polymyxins) or interfere with essential bacterial enzymes (rifamycins, lipiarmycins, quinolones, and sulfonamides) have bactericidal activities. Those that target protein synthesis (macrolides, lincosamides and tetracyclines) are usually bacteriostatic (with the exception of aminoglycosides).

Q. Gram-negative bacteria:

A. are mostly found in the GI and GU tracts

Response Feedback:

Gram-negative bacteria are most frequently found in the gastrointestinal or genitourinary tracts.

Gram-negative bacteria do not retain the violet dye due to the fact that they have a much thinner peptidoglycan layer which the stain does not adhere to. Compared to gram-positive bacteria, gram-negative bacteria are more resistant against antibiotics, because of their additional, relatively impermeable lipid membrane.

The pathogenic capability of gram-negative bacteria is often associated with the lipopolysaccharide (LPS) layer. In humans, LPS triggers an innate immune response.

Gram-positive bacteria have a thick layer of peptidoglycan, which takes up the (first) violet stain. Six gram-positive genera are typically pathogenic in humans. Two of these, Streptococcus and Staphylococcus are cocci (sphere-shaped bacteria). The remaining organisms are bacilli (rod-shaped bacteria) and can be subdivided based on their ability to form spores. The non-spore formers are Corynebacterium and Listeria, whereas Bacillus and Clostridium produce spores.

Q. Which of the following is NOT a caution for the use of cephalosporins:

A. allergy to aspirin

Response Feedback:

There is no caution about the use of cephalosporins with aspirin, however about 10% of patients with allergic hypersensitivity to penicillins also having cross-reactivity with cephalosporins. The cephalosporins are toxic to the kidneys and therefore plenty of water should be consumed when the patient is taking cephalosporins. Concurrent use of cephalosporins with aminoglycosides increases the nephrotoxic effect of both medications and therefore they should not be used together.

Cephalosporins are bactericidal and disrupt the synthesis of the peptidoglycan layer of bacterial cell walls. They were originally derived from a fungal poison "Cephalosporium" (now termed Acremonium).

Q. Which of the following is not a likely cause of antimicrobial resistance?

A. using narrow-spectrum antibiotics instead of broad-spectrum antibiotics

Response Feedback:

Narrow-spectrum antibiotic use does not contribute to antimicrobial resistance.

Q. The fluoroquinilones:

A. are used to treat hospital acquired gram-positive infections

Response Feedback:

The majority of quinolones in clinical use belong to the subset fluoroquinolones, which have a fluorine atom. Fluoroquinolones are broad-spectrum antibiotics, effective for both gram-negative and gram-positive bacteria. They play an important role in treatment of serious bacterial infections, especially nosocomial (hospital-acquired) infections and others in which resistance to older antibacterial classes is suspected.

Fluoroquinolones are often used for genitourinary infections, and are widely used in the treatment of hospital-acquired infections associated with urinary catheters. In serious cases of pyelonephritis (infection of the kidneys) or bacterial prostatitis, fluoroquinolones are recommended as first-line therapy.

Fluoroquinolones encourage the development of Clostridium difficile infections (one of the few bacteria they do not kill) and therefore are recommended to use only in more severe infections.

Q. A fungus is resistant to antibiotics because:

A. the composition of the fungal cell wall is unlike that of the bacteria

Response Feedback:

Fungi do not respond to antibiotics and in fact, most of the antifungal agents were originally discovered when investigating bacterial toxins.

Antifungals work by exploiting differences between mammalian and fungal cells to kill the fungal organism with fewer adverse effects to the host. But unfortunately, unlike bacteria, both fungi and humans are eukaryotes. Thus, fungal and human cells are similar at the biological level. This makes it more difficult to discover drugs that target fungi without affecting human cells. As a consequence, many antifungal drugs cause adverse effects, some of which can be life-threatening.

Q. Most antifungal agents work by which of the following mechanism?

A. alter cell permeability of the fungus, leading to cell death

Response Feedback:

Most anti-fungal agents work by disrupting the cell membrane.

Q. If your patient had a severe case of athlete's foot with lesions between the toes, which were oozing blood and serum, you would instruct him to do which of the following?

A. wear white socks, keep feet clean and dry and make sure the antifungal cream is not be used on any open lesions

Response Feedback:

Dermatophytes are the label for the fungi that commonly cause skin disease in animals and humans. Dermatophytes colonise the skin, hair and nails, obtaining nutrients from keratinised material. The organisms degrade the keratin causing inflammation in response to metabolic by-products. While these fungi do not normally break the skin, the patient will scratch the area, sometimes leaving open sores. It is important that these do not receive the antifungal cream, as the product will enter the bloodstream and it is toxic to humans.

Q. If the antifungal terbinafine is administered orally for more than 6 weeks for a fungal nail infection, the person should be advised to have:

A. liver enzyme levels and blood count monitored

Response Feedback:

Fungal infections of the nails (onychomycosis) are very difficult to treat with topical agents because they are located deep under the nail in the cuticle. Oral 250 mg terbitafine tablets are often prescribed for the treatment of onychomycosis. The drug builds up in the nails and hair, preventing fungal infections. However this results in many adverse effects including drug induced hepatitis and decreases in blood cells, therefore a liver function test and a full blood count should be done after 6 weeks of therapy.

Q. An antimicrobial drug mechanism of action generally regarded as bacteriostatic is often one that:

A. interferes with metabolic processes

Response Feedback:

A bacteriostatic agent is an agent that stops bacteria from reproducing, while not necessarily harming them otherwise. Bacteriostatic agents can achieve this by interfering with bacterial protein production, DNA replication, or other aspects of bacterial cellular metabolism.

Q. Tinea cruris is also known as:

A. jockstrap itch

Response Feedback:

Tinea cruris, also known as jock itch is a fungal infection of the groin. Tinea cruris has some similarities to candidal intertrigo, caused by Candida albicans in the fact that they are both fungal infections in the same area, but Candida is a fungus that is more easily eradicated.

Tinea capitis: Tinea of the scalp

Tinea pedis: Athlete's foot

Tinea unguium (or onychomycosis): Nail infection

Tinea corporis: Tinea of the body

Q. The use of amphotericin B is limited due to which of the following:

A. its life-threatening side effects

Response Feedback:

While effective in the treatment of systemic fungal infections, intravenously administered amphotericin B in therapeutic doses has also been associated with multiple organ damage. Nephrotoxicity is a frequently reported side effect, and can be severe and/or irreversible. Electrolyte imbalances (e.g., hypokalaemia and hypomagnesaemia), hepatotoxicity and fulminant liver failure are common. Several forms of anaemia and other blood dyscrasias and cardiac failure are also possible.

Q. Which of the following should a woman with repeated vaginal yeast infections keep on hand?

A. clotrimazole

Response Feedback:

Clotrimazole is commonly available as an over-the-counter antifungal, as a cream, and also (especially in the case of otitis media) as a combination medicine. It is also available as a throat lozenge (prescription only). For ear infections, it is often applied in liquid form, as ear drops. Clotrimazole alters the permeability of fungal cell walls and inhibits enzymatic activity within the cell.

Ciclopirox is a considered a hydroxypyridinone antifungal agent

Cipropirox is an antifungal that is used in onychomycosis (fungal infections of the nails), although amorolfine may be substantially more effective.

Butenafine is indicated for the topical treatment of tinea (pityriasis) versicolor and athlete's foot.

Q. The individual applying topical anti fungal agents should use care to prevent systemic absorption because:

A. these drugs are too toxic to be given systemically

Response Feedback:

Topical antifungal agents are very toxic if they go systemic.

The prokaryotes are a group of organisms like bacteria, whose cells lack a membrane-bound nucleus (karyon).

The eukaryotes are organisms whose cells do have a nucleus. Humans and fungi have eukaryotic cells, which makes it difficult to find substances that kill the fungus without harming the host.

Q. Locally active antiviral agents are most effective in treating:

A. warts

Response Feedback:

Topical antiviral agents may be effective in reducing or eliminating warts.

Providing no treatment at all is safe and cost effective, and should be considered as an option, since 65% of warts may regress spontaneously within 2 years. Treatment is recommended for patients with extensive, spreading, or symptomatic warts or warts that have been present for more than 2 years.

The other virally caused illnesses listed in the answers are all members of the herpes group and the treatment for herpes simplex is acyclovir or valacyclovir

Q. Which of the following is caused by a virus?

A. a common cold

Response Feedback:

The common cold is caused by a virus. This is why antibiotics are not useful in decreasing the signs, symptoms or length of the common cold.

If the patient has had the cold for over 7-10 days and then has an exacerbation with new or more profound symptoms, it is possible that the virus resulted in a bacterial infection. At that point, antibiotics may be useful.

Q. Which of the following is a correct statement about influenza or the difference between the common cold and influenza?

A. There is a vaccine for influenza but not for the common cold

Response Feedback:

There is a vaccine and antiviral drugs for influenza but not for the common cold. Influenza has a very rapid onset and a greater intensity than the common cold.

Q. HIV selectively enters which of the following cells:

A. helper T cells

Response Feedback:

The human immunodeficiency virus selectively enters the helper T cells because they have the two proteins that are specifically needed for attachment. One of the proteins needed is a receptor for cytokines. The small number of Caucasians who have a genetic error and are missing this protein are immune from HIV infection.

Q. The newest Direct acting antivirals for hepatitis C are:

A. 90% effective in eliminating the virus

Response Feedback:

The direct acting antiviral agents for Hepatitis C are 90% effective in eliminating the virus, are taken orally, have many fewer side effects than previous treatment, are taken for a shorter duration and currently anyone with an Australian Medicare card is eligible to receive therapy for a low cost.

Q. Herpes viruses cause a broad range of conditions but have not been identified as the causative agent in:

A. leprosy

Response Feedback:

Leprosy is caused by the bacterium Mycobacterium laprae (or lepromatosis), which are bacteria related to the Mycobacterium tuberculosis (the cause of tuberculosis).

The herpes group of viruses cause herpes type I (most often cold sores but can cause genital herpes), herpes type II (most often genital herpes, but can cause cold sores), chicken pox (appears as shingles when it reoccurs), and Epstein-Barr virus/cytomegalovirus (both causes of infectious mononucleosis or glandular fever).

Acyclovir is an antiviral agent that is effective in reducing the length and intensity of infection with most of these viruses. There is no cure for the virus and they can reoccur throughout the patient's life. The person with these viruses remains a carrier for life.

Q. The DNA polymerase inhibitors acyclovir and valacyclovir can suppress the symptoms of several viral infections except:

A. measles

Response Feedback:

The DNA polymerase inhibitor acyclovir can suppress the symptoms of the herpes viruses, herpes simplex I and II (cold sores and genital herpes), cytomegalovirus and Epstein-Barr virus (glandular fever), and the varicella zoster virus (chicken pox, shingles) but not measles.

The efficacy of these medications generally decreases rapidly after viral replication in the host cells, so should be commenced as soon as possible. (Remember what is happening: the virus goes into the first set of cells, reproduces and many more viral particles are released from that host cell. The host cell normally dies, and the immune and inflammatory systems need to clean up the mess that is left behind. Then more host cells are infected. The greater the number of infected cells, the greater the symptoms.)

Q. Viral infections have proven difficult to treat because they:

A. inject their DNA or RNA into human cells to survive and to reproduce

Response Feedback:

Viruses are difficult to treat because they inject their DNA or RNA into human cells to survive and to reproduce.

Usually viral infection occurs when a virus enters the host, either through a physical breach of the skin, by direct inoculation (mosquito bite; blood transfusion) or direct infection of the endothelial cells (skin, GIT and tracheal infections).

For the virus to reproduce and thereby establish infection, it must enter the cells of the host, using the proteins on the surface of the host's cells to attach. The virus forms a hole in the cell membrane of the host's cells and inserts its genetic contents.

After a virus has made many copies of itself in the host's nucleus, the host cell normally dies and the new viral particles find a new host cell. Antiviral agents normally disrupt one of these processes.

Q. The antiviral agents called neuraminidase inhibitors like zanamivir and oseltamivir are useful in treating:

A. influenza infection

Response Feedback:

Neuraminidase inhibitors like zanamivir (aerosol) and oseltamivir (oral) are a class of antiviral drugs that target the influenza virus. They work by blocking the function of the viral neuraminidase protein, thus preventing the virus from reproducing in the host cell.

The efficacy of these medications generally decreases rapidly after viral replication in the host cells, so should be commenced as soon as possible. (Remember what is happening: the virus goes into the first set of cells, reproduces and many more viral particles are released from that host cell. The host cell normally dies, and the immune and inflammatory systems need to clean up the mess that is left behind. Then more host cells are infected. The greater the number of infected cells, the greater the symptoms.)

Q. The benefit of pegylating interferon (PEG-interferon) is:

A. it allows less frequent administration of doses

Response Feedback:

The addition of polyethylene glycol to the interferon, through a process known as pegylation, enhances the half-life of the interferon to

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Q. Current antiviral therapy against HIV include all of the following EXCEPT:

A. proteins that prevent the entrance of the virus into the blood stream

Response Feedback:

We do not have medications to block the virus from accessing our bloodstream, but all of the other mechanisms are important to remember.

Q. Acyclovir:

A. decreases length of time and severity of herpes outbreaks

Response Feedback:

Acyclovir, valacyclovir and other anti herpes medications will decrease the length of time of the outbreak and decrease the severity of the outbreak but only if taken early. While acyclovir is not very cytotoxic, it

should be consumed with plenty of water to reduce the possibility of Acyclovir crystalline nephropathy. The crystalline nephropathy is much more likely when the drug is infused.

Patients with herpes simplex can pass the virus to a partner even when on the antiviral agent. Acyclovir does not eliminate the virus..

Q. Viruses are best defined as:

A. infectious agents

Response Feedback:

A virus is a small infectious agent that replicates inside the living cells of other organisms. A virus is not a cell, but rather a protein coat or capsid that contains DNA or RNA that it injects into the host cell.

*Conversely, a microbe or microorganism is a microscopic** single- or multi-celled organism. Microbes can be infected by viruses, and this may account for some of the genetic changes that they incur (the virus injecting its genome into the cell).*

Viruses are so small they cannot be identified under an electron microscope and instead, their presence is confirmed by antibodies the patient has developed to the virus.

Q. A vaccination is available for all of the following EXCEPT:

A. HIV

Response Feedback:

There are no vaccinations against HIV at this point, but the antiviral therapies have become very effective in keeping the viral load down and decreasing the transmission of the HI virus during unprotected sex.

Some vaccines contain killed, but previously virulent, micro-organisms that have been destroyed with chemicals, heat, radioactivity, or antibiotics. Other vaccines contain live microorganisms that have been cultivated in conditions that disable their virulent properties. Other vaccines use a fragment of the whole virus, for instance, the vaccine against Hepatitis B virus is composed of only the surface proteins. Regardless of the technique used, vaccines are designed to expose the immune system to the antigenic proteins of the infective agent so that it responds very quickly when the real virus invades the host.

Since vaccinations contain proteins that are highly immunogenic, hypersensitivity type I reactions can develop from these immunogenic substances. Therefore, vaccinations can cause anaphylaxis (anaphylactic shock). Normally the person receiving the vaccination is asked to wait for 15 minutes after vaccination to ensure that this will not be experienced.

***Question:** In regard to the adverse effects associated with vaccination, a significant concern is:*

there is no prophylactic treatment for the febrile state and local reactions that commonly develop

the onset of anaphylactic reactions

there is no information readily available to families about the risks of this treatment

that convulsions and brain damage are relatively common consequences

Q. One of the interferons would be indicated in the treatment of the following except:

A. myasthenia gravis

Response Feedback:

All interferons share several common effects; they are antiviral agents and can fight tumours. They also have a place with some intracellular bacteria, but they are not effective in autoimmune disorders like myasthenia gravis.

MULTIPLE CHOICE QUESTIONS AND ANSWERS

WEEK 05

Q. All of the following are true about Oxytocin EXCEPT:

A. It is normally administered in tablet preparations

Response Feedback:

Oxytocin is normally intravenously or nasally administered, but all of the other choices in the question are correct.

Q. Growth hormone deficiency in children is commonly idiopathic. The definition of idiopathic is:

A. without identifiable cause

Response Feedback:

Idiopathic means 'with no identifiable cause'. Although growth hormone deficiency is commonly idiopathic, it is often caused by a lack or love or sleep.

Individuals receiving growth hormone supplements (somatropin) should be monitored for thyroid function and glucose tolerance. You may not be up to the diabetes portion of this system, but if you are, recall that growth hormone is one of the hormones that helps to protect against hypoglycaemia and therefore can cause hyperglycaemia (diabetes mellitus; diabetes can be type I, type II or hormone/drug-induced)

Question: People who are receiving growth hormone replacement therapy must be monitored very closely. Routine follow-up examinations would include:

a bowel program to deal with constipation

tests of adrenal hormone levels

a calorie check to control weight gain

tests of thyroid function and glucose tolerance

Q. Growth hormone deficiencies:

A. can occur in adults as well as children

Response Feedback:

Growth hormone deficiencies can occur in both adults and in children. In newborn infants, the primary manifestations may be hypoglycaemia; whereas in later infancy and childhood, growth will be affected.

Deficiency in adults is rare, but may feature diminished lean body mass, decreased bone density, decreased muscle mass, poor memory, social withdrawal and depression. The continued secretion of growth hormone in adults is necessary for optimal physical and psychological health, helps protect us from hypoglycaemia and is the primary reason that our ears, nose and other cartilaginous structures continue to grow throughout life.

One of the causes of decreased production of growth hormone in children occurs when the child is abused or neglected, or has disturbed sleep, especially in the first few hours of their sleep. Growth hormone is predominantly secreted in the first hour of sleep.

Q. A lack of endogenous (from within one's body) ADH (vasopressin) is often resolved with:

A. DesmoPRESSIN and other ...PRESSIN drugs

Response Feedback:

A lack of ADH (vasoPRESSIN; the water saver) is often with desmopressin. Desmopressin is also used to prevent bed wetting (helps save water through the night)

Desmopressin, a synthetic preparation of ADH (vasopressin) is mainly used in the treatment of ADH insufficiency (diabetes insipidus), and can cause symptoms similar to hangovers (tremor, sweating, vertigo, light-headedness, headache).

Comparing the symptoms of excess ADH to a hangover may confuse some students but both ADH and alcohol have the ability to produce electrolyte abnormalities – ADH by over-hydration and alcohol by dehydration.

Desmopressin is not an accepted cure for hangovers and alcohol is not recommended to "balance" the adverse effects of desmopressin.

Ergometrine is a medication that is used to initiate labour, oxytocin is the preferred medication to initiate labour and somatotropin is a medication used to treat growth hormone deficiency.

Question: Side effects of desmopressin include:

constipation and paralytic ileus

hangover symptoms, including headache, sweating and tremors

nocturia and bed wetting

cholecystitis and bile obstruction

Q. The posterior pituitary gland:

A. stores ADH and oxytocin, which are produced in the hypothalamus

Response Feedback:

The posterior pituitary gland secretes ADH (the water saver) and oxytocin (important in lactation and maternal bonding), however the hypothalamus synthesises these hormones, stores them in the posterior pituitary gland and they are released on stimuli from the hypothalamus. In many anatomic and functional aspects, the posterior pituitary gland appears to be more a part of the hypothalamus than the anterior pituitary gland.

Q. Which organ is normally considered the controlling organ of the endocrine system?

A. The hypothalamus

Response Feedback:

The hypothalamus is considered the controlling organ of the endocrine system. Advance your knowledge with the following question.

When used as drugs, hypothalamic hormones:

are used to treat of auto-immune disorders

are used to diagnose endocrine disorders or as antineoplastic agents

are used to treat a number of central nervous system disorders

are frequently used in the treatment of multiple endocrine disorders

B is correct. When used in the medical setting, hypothalamic hormones are most often used for diagnostic purposes or as antineoplastic agents. Recall that the hormones of the hypothalamus are secreted into the hypothalamus-pituitary portal venous system rather than the general venous system. This means that the response needed will require only minute quantities of the hormone, as the blood carries these chemicals directly to the site of the receptors.

The most commonly used hormone from the hypothalamus is corticotropin releasing hormone (CRH), which stimulates adrenocorticotropic hormone (ACTH) from the anterior pituitary gland and is used to diagnose Cushing's disease.

Q. The hypothalamus can be considered the master endocrine gland because:

A. it secretes releasing hormones that are an important part of the hypothalamic-pituitary axis

Response Feedback:

The hypothalamus is often considered the controlling organ of the endocrine system because it secretes 8 hormones that are an important part of the hypothalamic-pituitary axis. The hypothalamus receives information from higher brain centres, from hormones, and from other sources, responding to those by the release of hormones to the pituitary gland and neural projections to higher brain centres. The hypothalamus controls hunger, temperature, thirst, sleep, circadian rhythms and many other functions.

Q. Acromegaly and gigantism are both conditions related to excessive secretion of:

A. growth hormone

Response Feedback:

Acromegaly and gigantism are both conditions related to excessive secretion of growth hormone. Gigantism is still the (insensitive) term used when the growth hormone excess occurs prior to the epiphyseal plates close. The child/adolescent grows significantly taller than otherwise expected.

Acromegaly occurs after epiphyseal plates close. It results in severe disfigurement, complicating conditions, and premature death if unchecked. Because of its slow progression, the disease is hard to diagnose in the early stages and is frequently missed for years until changes in external features, especially of the face, become noticeable.

Q. The endocrine glands:

A. form part of the communication system of the body

Response Feedback:

The endocrine system is similar to the nervous system in that it is a type of communication system. However, the nervous system sends information very quickly, uses neurotransmitters as their chemical mediators, and responses are generally short lived.

By contrast, the endocrine system's effects are slow to initiate and prolonged in their response, lasting from a few hours up to weeks. Hormones are the chemical mediators released from endocrine glands (most often) into the bloodstream, where they travel to target tissue and generate a response. Hormones regulate various functions, including metabolism, sleep, mood, growth, development and other functions.

Finally, our immune cells communicate with each other with chemical messengers called prostaglandins, leukotrienes, interferons and related chemicals.

Q. Somatropin is a genetically engineered growth hormone that is used:

A. in the treatment of growth hormone deficiencies

Response Feedback:

Somatropin is used in growth hormone deficiencies. For instance, children with growth failure due to lack of growth hormone, in the treatment of short stature associated with Turner syndrome (a chromosomal disorder in which the patient has only one sex-chromosome) and for people with AIDS to increase protein production and growth.

Fortunately, the abuse of growth hormone by athletes is limited by its cost and the fact that anabolic steroids (testosterone and its derivatives) are simply more enticing to athletes. Nonetheless, if someone you know is taking growth hormone for muscular development, they should be warned about acromegalic syndrome. Use of anabolic steroids and/or growth hormone in those without deficiency are associated with increased morbidity and mortality.

Q. Which of the following is correct about antidiuretic hormone (ADH)?

A. it causes the retention of water by the kidneys

Response Feedback:

ADH (anti-diuretic hormone or vasopressin) is the water saver. ADH is secreted from the posterior pituitary gland in response to the Renin-angiotensin-aldosterone mechanism, reductions in plasma volume and other factors.

Anti-hypertensive drugs can work by decreasing the release or actions of ADH. It may help to think of this as a double negative - ANTI-ANTI diuretic = a diuretic, A diuretic is any substance that promotes the production of urine.

Q. Diabetes insipidus is a relatively rare disease characterised by:

A. the production of large amounts of dilute urine containing no glucose

Response Feedback:

Diabetes insipidus is a condition in which there is too little ADH (the water saver), resulting in a diuretic effect (the production of large amounts of dilute urine containing no glucose).

To understand this, consider the derivation of the words. 'Diabetes' comes from the Greek word meaning 'to siphon' and is meant to denote what is happening at the kidneys. The word 'mellitus' comes from the word meaning 'sweet'. So in the case of 'diabetes mellitus', it literally means 'to siphon sweet urine' (patients with diabetes mellitus have glucose in their urine). 'Insipidus' comes from the Greek word meaning 'tasteless', and therefore means 'to siphon or excrete tasteless urine'.

When a person has too little ADH the WATER SAVER, they WASTE WATER, or excrete way too much. That condition is called Diabetes insipidus, and is treated with exogenous ADH, or desmopressin.

Q. In cases of growth hormone hyposecretion, therapy involves the use of:

A. somatropin

Response Feedback:

Q. You are given this example:

A variable in the body changes; the change is detected by a sensor; the sensor sends a message to an integrating centre; the integrating centre stimulates an effector; the effector does something to return the variable to its original level.

What is this known as?

A. Negative feedback

Response Feedback:

Almost all homeostatic control mechanisms are negative feedback mechanisms. These mechanisms change the variable back to its original state or "ideal value".

A good example of negative feedback is the control of blood pressure. As blood pressure increases, receptors in the carotid arteries detect the change in blood pressure and send a message to the brain; the brain will cause the heart to beat slower and thus decrease the blood pressure.

Conversely, there are a few examples of positive feedback. For instance, when contraction of the uterus starts, oxytocin is released which stimulates more contractions and more oxytocin to be released. In this way, contractions increase in intensity and frequency, which is the stimulus to increase the release of oxytocin.

Q. An endemic goitre is a type of hypothyroidism caused a deficiency of iodine. Treatment will be:

A. iodine supplementation

Response Feedback:

Iodine supplementation is supported in people who have endemic goitre. However, iodine induced hyperthyroidism is frequently observed in patients affected by iodine deficient goitre when suddenly exposed to excess iodine. For reasons that are somewhat unclear, the safeguard mechanisms that protect the thyroid gland may break down in some patients who are exposed to excess amounts of iodine, so it is important to prevent iodine toxicity.

Question:Which of the following statements is correct?

Iodine-induced hyperthyroidism is frequently observed in patients affected by iodine deficient goitre when suddenly exposed to excess iodine

A high dose of iodine should be given to treat a patient with suspected hypothyroidism

Iodine should always be tried in a patient with goitre

Iodide has a long half-life and greatly reduces the release of thyroid hormone for up to one month

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Q. Goitre, or enlargement of the thyroid gland, is NOT associated with:

A. hyperparathyroidism

Response Feedback:

While the mechanism by which goitre forms is different for each condition, goitre is associated with hyperthyroidism, hypothyroidism and iodine deficiencies. Worldwide, the main cause of goitre is iodine deficiency, however in industrialised

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Q. Generally, L-thyroxine (T-4) is preferable to liothyronine (T-3) as therapy in hypothyroid states because:

A. all of the choices are true

- it has a longer duration of action
- it is less cardio-toxic
- levels are easier to monitor

Response Feedback:

L-thyroxine is the preferred treatment for hypothyroidism. However some people with hypothyroidism are not able to convert their T4 into the more active T3 and for those patients, both may need to be used together.

Q. The treatment of hyperthyroid states does not become apparent immediately because:

A. there is a relatively large store of thyroid hormone

Response Feedback:

The clinical effects of thionamides for hyperthyroid states do not become apparent until stores of thyroid hormones become depleted, which takes about 21-28 days after the start of therapy.

Question: The clinical effects of thionamides for hyperthyroid states do not become apparent until stores of thyroid hormones become depleted, which takes about ___ after the start of therapy.

1 day

5-7 days

7-14 days

21-28 days

Q. Radioactive iodide may be used to treat hyperthyroidism because:

A. it destroys functional thyroid tissue

Response Feedback:

Radioactive iodine is taken up into the cells that are hyper-secreting thyroid hormone and kills them.

Q. Thyroid replacement therapy is indicated for the treatment of:

A. hypothyroidism and myxoedema

Response Feedback:

Thyroid replacement therapy is indicated for hypothyroidism and severe hypothyroidism (myxoedema). While thyroid hormone was once used for weight loss, thyroid hormone is no longer considered a good choice for treating obesity.

Graves' disease is a form of hyperthyroidism, and although it often eventually results in hypothyroidism, thyroid hormone is not a therapy for Graves' disease.

Myxoedema is not a specific disorder but rather a severe form of hypothyroidism. Myxoedema is also a term used to describe a dermatological condition that can occur in hypothyroidism and occasionally in Graves' disease. In this context, myxoedema refers to deposits of mucopolysaccharides in the interstitial spaces. This type of oedema is non-pitting, in other words, does not retain a depressed appearance on the skin after pressing on the area for 5 seconds.

Q. The thyroid gland produces the thyroid hormones T3 and T4 which are dependent on the availability of:

A. iodine found in the diet

Response Feedback:

The production of thyroid hormones triiodothyronine (T3) and thyroxine (T4) need iodine to be formed. Iodine is an element (like zinc, iron, magnesium, phosphorus, boron, etc.) and as such, cannot be created in the liver (matter [elements] cannot be created nor destroyed).

A deficiency of iodine leads to decreased production of T3 and T4, and the thyroid gland enlarges (hypertrophies) in its attempt to sequester as much of the iodine in plasma as possible. T4 is converted to the MORE active T3 (four times more potent than T4) in the liver. Dietary selenium, another element, is essential for T3 production.

Q. The thyroid gland is dependent on the hypothalamic-pituitary axis for regulation. As the levels of thyroid hormone increase:

A. the hypothalamic release of TRH would be decrease or be suppressed.

Response Feedback:

When the hypothalamus determines the need for more thyroid hormone, as when one is cold, it secretes thyroid releasing hormone (TRH) which is the signal for the pituitary gland to release thyroid stimulating hormone (TSH). The TSH stimulates the release of T4 from the thyroid, which is changed to the more active T3 in the liver. Thyroid hormone itself acts on the hypothalamus in a negative feedback fashion, meaning that pharmacologic preparations will decrease the release of TRH upon administration.

Q. Long-term uncontrolled hyperglycaemia results in:

A. thickening of the capillary basement membrane

Response Feedback:

Long-term hyperglycemia results in thickening and stiffening of the collagen in the capillary basement membrane due to the glycation of proteins. When we think of a thickened, stiff collagen, it is easy to assume that this makes the structure stronger, but it is weaker. Glycation actually weakens the collagen in the blood vessel walls leading to micro- and/or macro-aneurisms.

Glycation is the result of a bonding of proteins with a sugar molecule. It is a haphazard process that impairs the functioning of biomolecules.

Long-lived cells such as nerves and long-lasting proteins such as those in the lens of the eye and in the glomerulus of the nephrons are especially prone to the damaging effects of glycation. This is the reason that diabetics are susceptible to disorders of the kidneys, eyes, neurons and cardiovascular system.

Q. Which statement is true about oral hypoglycaemic drugs?

A. This group of drugs alters liver function or increases effectiveness of endogenous insulin or increases beta cell release of insulin

Response Feedback:

Many oral hypoglycaemic drugs work by altering liver function or increasing the effectiveness of endogenous insulin and the sulfonylureas increase beta cell release of insulin. There must be functioning pancreatic beta cells for these drugs to be effective, so they are not used in diabetes mellitus type I.

Q. Educating a newly diagnosed diabetic (type II or gestational diabetes) about their health should include:

A. diet and exercise changes that are needed

Response Feedback:

Before any drugs are given, the newly diagnosed diabetic (type II or gestational diabetes) should receive counselling about their diet and exercise program. A good diet and exercise regimen can often keep the diabetes in check for years without drugs.

While the most common types of hyperglycaemia normally respond to the above therapy, the less common forms of diabetes need special drug therapy. Patients with diabetes mellitus type I will need instructions on how to administer their insulin therapy. Other types of diabetes mellitus are caused by excess growth hormone, excess glucocorticoids, excess thyroid hormone or excess adrenaline. Those patients will need therapy to return their hormones to normal level.

Q. The HbA1c or glycated haemoglobin blood test is a good measure of overall glucose control because:

A. it reflects the average level of glucose in the body over a longer period of time

Response Feedback:

The HbA1c or glycated haemoglobin blood test is a good measure of overall glucose control because it reflects the average level of glucose over the past weeks to 3 months rather than the normal "snapshot in time" readings.

When blood glucose levels are high, glucose molecules attach to the haemoglobin in red blood cells. The longer hyperglycaemia occurs in blood, the more glucose binds to haemoglobin in the red blood cells and the higher the glycated haemoglobin.

Q. In the treatment of type 2 diabetes, a sulfonylurea agent must be administered with food because:

A. it could otherwise cause hypoglycaemia

Response Feedback:

Since sulfonylureas increase pancreatic production of insulin, they can cause hypoglycaemia. Taking a sulfonylurea with a meal reduces the danger of hypoglycaemia.

Please don't let the discussions of hypoglycaemia get you confused. Diabetes mellitus is a disorder of hyperglycaemia (IN EVERY TYPE). The only time hypoglycaemia happens in diabetes is when an inappropriate amount of drugs is taken for the conditions.

Q. The pathophysiology of type 1 diabetes mellitus is associated with:

A. an autoimmune destruction of pancreatic beta cells

Response Feedback:

Diabetes mellitus type I is an autoimmune destruction of the pancreatic beta cells resulting in NO insulin.

Diabetes mellitus type II is the disorder that is associated with cellular insulin resistance, and increased levels of endogenous (from within) insulin.

Q. A patient with diabetes is likely to present with:

A. polyuria and polydipsia

Response Feedback:

Patients who have recently developed hyperglycaemia often present with polyuria and polydipsia (an increase in urine production and increase in thirst). This is because a patient with hyperglycaemia has more glucose in their blood than the amount that can be reabsorbed in the tubules. The excess glucose then acts in an osmotic way, pulling water into the tubules. This results in excess urine and the thirst follows.

Although many authors still claim that hyperglycaemia itself causes polyphagia (increased hunger), this only occurs in diabetes mellitus type I and is due to the absence of insulin.

Patients who ignore these first symptoms of hyperglycaemia often begin to consider the polyuria and polydipsia as part of their body's normal functions. Their presenting symptoms are normally visual disturbances.

Polyadenitis is an inflammation of the lymph nodes. Polycythaemia is a disease state in which the proportion of blood volume that is occupied by red blood cells increases (e.g. polycythaemia vera). Polyarteritis is a type of vasculitis or inflammation of the blood vessels (e.g. polyarteritis nodosa which affects the small and medium sized arteries).

Q. A drug group that tends to raise blood glucose levels is:

A. oral contraceptives

Response Feedback:

Oral contraceptives often raise blood glucose levels.

Thyroid hormones, glucagon, growth hormone, adrenaline, and glucocorticoids all raise blood glucose levels, and excess levels of these hormones (or drugs that mimic these hormones) will raise blood glucose levels.

Possible Multiple choice question: which of the following DOES NOT RAISE BLOOD GLUCOSE LEVELS? (choices would include three of the above and one that is not)

Q. Currently, the medical management of diabetes mellitus type II is aimed at:

A. regulating blood glucose levels

Response Feedback:

The medical management of diabetes type II focuses on the control of glucose levels in the blood. This is done with diet and exercise at first. Later, hypoglycaemic agents will be used and some people with Type II diabetes may be given insulin therapy in the later stages, as their beta cells begin decreasing their production (prior to that, insulin levels for these patients are raised).

Those with Type I diabetes will attempt to regulate glucose levels as well, but because they have no insulin produced endogenously, they will need injections of insulin for the duration of their lives.

The medical management of hyperglycaemia caused by increased levels of cortisol, thyroid hormone, growth hormone and adrenaline is normally aimed at treating the cause of those hormonal abnormalities.

Q. The first line of drug therapy for the treatment of diabetes type II is:

A. The biguanide metformin

Response Feedback:

Metformin is an anti-diabetic drug in the biguanide class (drugs that suppress glucose production by the liver). It is normally the first line of drug therapy for type II diabetes after exercise and dietary changes fail to keep blood glucose under control. Metformin is the only anti-diabetic drug that has been conclusively shown to prevent the cardiovascular complications of diabetes. It helps reduce LDL cholesterol and triglyceride levels and is not associated with weight gain.

In large studies over 10 years of treatment, metformin reduced diabetes complications and overall mortality by about 30% when compared with insulin or sulfonylurease, and about 40% when compared with the group only given dietary advice. Metformin is not recommended in gestational diabetes, as it is

classified as a Class C drug, meaning that while there is no evidence of teratogenesis or adverse fetal effects, insufficient data exist to state that harm does not occur.

Q. The thyroid gland is dependent on the hypothalamic-pituitary axis for regulation. As the levels of thyroid hormone increase:

A. the hypothalamic release of TRH would be decrease or be suppressed.

Response Feedback:

When the hypothalamus determines the need for more thyroid hormone, as when one is cold, it secretes thyroid releasing hormone (TRH) which is the signal for the pituitary gland to release thyroid stimulating hormone (TSH). The TSH stimulates the release of T4 from the thyroid, which is changed to the more active T3 in the liver. Thyroid hormone itself acts on the hypothalamus in a negative feedback fashion, meaning that pharmacologic preparations will decrease the release of TRH upon administration.

Q. An injection of glucagon would be appropriate for which of the following?

A. A person with drug-induced hypoglycaemia

Response Feedback:

Glucagon raises blood glucose levels and would be used in a person with hypoglycaemia. Hypoglycaemia occurs when the person has given a dose of hypoglycaemic agents that was too high for the conditions. For instance, when they inject insulin assuming they will have a meal in 30 minutes, and their child needs to be taken to the doctor very quickly. The insulin will force the sugar levels down, without any new glucose coming in. Glucagon or simply glucose lozenges are needed in that case.

Diabetes insipidus is a condition of too little ADH, the water saver and has nothing to do with glucose.

Q. The second-generation sulfonylurea glimepiride works primarily by:

A. increasing pancreatic release of insulin

Response Feedback:

Sulfonylureas act by increasing insulin release from the beta cells in the pancreas. Sulfonylureas can induce weight gain, mainly as a result of their effect on increasing insulin levels and thus utilization of glucose and other metabolic fuels.

Sulfonylureas are potentially teratogenic and cannot be used in pregnancy or in patients who may become pregnant. Insulin therapy is typically recommended during pregnancy and in hepatic and renal failure, although some of the agents being developed may be more appropriate in the near future.

All sulfonylureas carry warnings about increased risk of cardiovascular death. First line therapy with sulfonylureas significantly increases the risk of death in patients with type 2 diabetes, when compared with treatment using metformin. The combination of metformin and a sulfonylurea was also associated with a significantly increased risk of death, when compared with combination therapy of metformin and a dipeptidyl peptidase-4 (DPP-4) inhibitor.

Given the research suggesting increased mortality combined with the fact that hyperinsulinaemia itself has been implicated in a number of adverse health consequences recently, it may be prudent to help patients choose another therapy.

Q. Insulin is available in several forms of suspensions, which differ in their:

A. onset and duration of action

Response Feedback:

Insulin is available in several forms of suspensions, which differ in their range of peaks and duration of action. The types of insulin used are determined by the anticipated eating and exercise activities.

Insulin is indicated for people with type I diabetes mellitus, and individuals with that disorder will die of cellular lack of glucose and ketoacidosis (despite generalised hyperglycemia) without their injections. Therefore, there are no contraindications. Insulin does not cross the placenta and does not enter breast milk.

Q. Acarbose is an anti-diabetic drug that:

A. inhibiting the enzymes needed to digest carbohydrates, thereby delaying the absorption of glucose, leading to lower glucose levels

Response Feedback:

Acarbose inhibits the enzymes needed to digest carbohydrates. These enzymes are released from the brush border of the small intestines and the pancreas.

Since acarbose prevents the degradation of complex carbohydrates into glucose, some carbohydrates will remain in the intestine and be delivered to the colon. In the colon, bacteria digest the complex carbohydrates, causing gastrointestinal side-effects such as flatulence (80% of patients). The carbohydrates will also pull more water into the GIT, as some of them remain osmotically active. These effects are dose-related, so the symptoms can be reduced by reducing carbohydrate consumption or by starting with a low dose and gradually increasing the dose to the desired amount.

Acarbose is inexpensive but not popular in the USA. Some clinicians from that country believe that acarbose is not potent enough to justify the GIT complaints that result from its administration.

Q. Which of the following is NOT a steroidal hormone from the adrenal cortex?

A. adrenaline

Response Feedback:

Adrenaline is a non-steroidal hormone synthesised within the adrenal medulla, NOT the cortex where the steroidal hormones are synthesised. The adrenal medulla works with the sympathetic nervous system, but rather than releasing neurotransmitters, the cells of the adrenal medulla secrete the adrenaline and noradrenaline as hormones.

Each of the steroidal hormones listed are synthesised within the adrenal cortex. Cortisol is an anti-inflammatory steroidal hormone. Aldosterone is the salt saver. The precursor to testosterone is an anabolic steroidal hormone called androstenedione. Therefore the statement "the patient is on steroids" does not give you very much information about what they are actually taking.

If the person is taking steroids for their asthma, they are probably on glucocorticoids (cortisol-like drugs) like prednisolone.

If the person is taking steroids to increase muscle mass after cancer treatment, they are probably on anabolic steroids like testosterone

Always ask what kind of steroids the person is taking.

Q. A person is started on a regimen of prednisone because of a crisis in her ulcerative colitis. Care of the person would need to include:

A. administration of the drug around 8 or 9 am to mimic normal diurnal rhythm

Response Feedback:

Cortisol, the stress hormone, is released in a diurnal (having a daily) pattern, which peaks in the morning. Patients who work night shifts may need to address their administration accordingly.

Q. The adrenal medulla:

A. is a neural ganglion of the sympathetic nervous system

Response Feedback:

The adrenal medulla is a neural ganglion of the sympathetic nervous system and should be considered part of the SNS. It provides a back-up of noradrenaline and adrenaline (in the form of hormones rather than neurotransmitters) for the SNS.

All other choices are relevant to the adrenal cortex, the outer portion of the adrenal gland that produces steroidal hormones (cortisol, aldosterone and testosterone precursors).

Q. If a patient suddenly stopped glucocorticoid treatment (cortisol like drugs; prednisone, prednisolone) after receiving it for an extended period of time, you would expect to find symptoms of a lack of cortisol, which would include:

A. physiological exhaustion, shock, and fluid shift

Response Feedback:

Physiological exhaustion, shock, and fluid shifts can occur when patients abruptly discontinue corticosteroid use after having been on them for over a month or so. This is a type of adrenal crisis.

Adrenal crisis can occur from within the adrenal gland itself (a primary adrenal crisis) or from a malfunction at the level of the pituitary gland (secondary adrenal crisis). When someone takes corticosteroids for an extended length of time, the negative feedback the drug signals at the level of the hypothalamus decreases the production of CRH. This means the pituitary has no signal to release the ACTH and the cells that secrete the ACTH enter a dormant phase.

Slow withdrawal of the drug is needed to slowly allow the pituitary to recommence production of ACTH.

Q. Diurnal rhythm in a person with a regular sleep cycle would show:

A. increasing levels of ACTH from midnight to the time of awakening

Response Feedback:

In a person with a regular sleep cycle, diurnal rhythm would show increasing levels of ACTH from midnight to the time the person awakens. Peak ACTH is about an hour before a person awakens while peak cortisol occurs upon awakening. Understanding the normal patterns of secretion of hormones will help you understand why certain drugs need to be administered in certain ways.

Q. During spironolactone therapy, the blood levels of __ should be monitored

A. potassium

Response Feedback:

During spironolactone therapy, blood levels of potassium should be monitored. Spironolactone is a diuretic that will be discussed more later this year. The reason it is presented briefly here is because it is a mineralocorticoid antagonist. It decreases the salt saving actions and as such, wastes salt and increases potassium levels.

Q. Many patients are on long-term corticosteroid treatment for treatment of asthma or autoimmune disorders or to reduce graft rejection. These patients should:

A. be protected from exposure to infections and invasive procedures

Response Feedback:

Yes, extra care should be taken with patients who are on corticosteroids in an attempt to reduce infection, as these drugs decrease the immune response.

Why are people on corticosteroids susceptible to infections?

Glucocorticoids are stress hormones that help us out of acute stress (like hypoglycaemia or too little fluid in the blood vessels). In that type of situation, we need to decrease the activity of cells that we don't need as much. So every arm of the immune system is decreased when we have an acute stress. The trouble is that when drugs similar to these hormones are used (in pharmacological doses which are much greater than physiological doses), there is a massive decrease in the immune system. Decreasing every arm of the immune system allows many pathogens to go unchecked.

Q. Which of the following corticosteroids is classified as an intermediate-acting agent?

A. Prednisolone

Response Feedback:

Drugs ending in -sone or -solone are glucocorticoids (anti-inflammatory steroids) Prednisolone is an intermediate acting oral steroid, while Dexamethasone is a long acting oral steroid. Hydrocortisone is a topical steroidal cream and Budesonide is a nasal spray (with more than one active ingredient; hence the name is not a -sone).

Q. A specific immune-related effect associated with the glucocorticoid action is:

A. reduction in the size and substance of lymph nodes and spleen

Response Feedback:

Glucocorticoids can reduce the size of the spleen and lymph nodes. They also decrease protein synthesis, stabilise T cells, and decrease neutrophil and macrophage responses.

Q. Which one of the following effects is not associated with adrenocorticoid hormones?

A. the enhancement of immune processes

Response Feedback:

The hormones from the adrenal cortex are steroidal hormones associated with the distribution of body hair (the androgens), sodium and water retention (mineralocorticoids and the glucocorticoids have some mineralocorticoid properties), increases in blood glucose (glucocorticoids) and DECREASED immune responses (glucocorticoids).

Q. Glucocorticoids are hormones that:

A. promote the preservation of energy through increased glucose levels, protein breakdown, and fat formation

Response Feedback:

Glucocorticoids promote the preservation of energy through increasing glucose levels, protein breakdown, and fat formation. Glucocorticoids are stress hormones that are important in preventing hypoglycaemia. They do this by increasing glucose, taking proteins and breaking them down for use in preference to glucose and forming fat in areas that can easily be accessed for energy in the future.

Glucocorticoids are also important in the fact that they decrease many aspects of immune function. While this is not normally too significant in physiological doses, pharmacologic glucocorticoids like cortisone, hydrocortisone and prednisone can be exploited for their ability to decrease immune reactions.

Refer to the above to help you understand why these drugs can cause a type of diabetes mellitus (their hyperglycaemic effect); central obesity and fat pads in the face (moon facies) and shoulders (fat formation in areas that are easily broken down for energy); thin skin and easy bruising (protein degradation).

Q. A typical adverse effect profile of systemic corticosteroid therapy includes:

A. fluid retention, altered mood, altered blood pressure, hypokalemia, hyperglycemia and impaired wound healing

Response Feedback:

Systemic corticosteroids often cause fluid retention (mineralocorticoid effects of glucocorticoids; salt saving), altered mood, altered blood pressure (higher because of salt retention), hypokalemia (when you save salt, you waste potassium), hyperglycaemia (GLUCOcorticoids raise GLUCOSE) and impaired wound healing (the decrease in immune system response combined with the protein-wasting effects).

Q. The glucocorticoids have a role in the therapy associated with:

A. hypovolemic shock

Response Feedback:

The glucocorticoids have a role in the treatment of hypovolemic shock. Glucocorticoids can CAUSE osteoporosis, hypertension, and high blood sugar levels.

Q. In adrenal insufficiency, mineralocorticoids:

A. are always given in conjunction with appropriate glucocorticoids

Response Feedback:

Adrenal insufficiency results in decreased Glucocorticoids and decreased Mineralocorticoids. Mineralocorticoids such as aldosterone (no longer available for pharmacological use and replaced with fludrocortisone) are salt savers and potassium wasters. Glucocorticoids are steroidal hormones important in maintaining glucose balance (and also have strong anti-inflammatory actions).

Q. Men taking Alprostadil for treatment of erectile dysfunction must:

A. learn to inject the drug directly into the penis

Response Feedback:

Alprostadil, a prostaglandin E1 analogue, degrades very quickly and needs to be injected directly into the penis to address erectile dysfunction. Alprostadil is also used to increase blood flow and increase angiogenesis (new blood vessel formation) to ischaemic limbs. It begins working within 5 minutes.

Sildenafil (Viagra) is the drug that is taken orally about 1 hour before anticipated intercourse.

Q. Illegal use of large quantities of unprescribed anabolic steroids to enhance athletic performance has been associated with:

A. cardiomyopathy and liver cancers

Response Feedback:

Anabolic steroid (testosterone) abuse is associated with cardiomyopathy, liver cancer, male breast development, loss of hair, and has many other adverse effects.

Q. Oxytocin, synthetic form of the posterior pituitary hormone, is used to:

A. induce labour by stimulating uterine contraction

Response Feedback:

Injected (or nasal) oxytocin analogues are used for inducing labour and to support labour in case of difficult parturition. It is also used to increase uterine tone in acute postpartum haemorrhage.

Oxytocin is also used in veterinary medicine to stimulate milk release, but is no longer used in humans for that purpose, as studies are finding it less beneficial than originally hypothesised.

Oxytocin was discussed in the very first part of this lecture series as we discussed the hypothalamus - posterior pituitary gland, and has replaced egometrine as the first choice for initiating labour and controlling postpartum haemorrhage

Q. Any person who is taking oestrogens, progestins, or combination products should be cautioned to avoid smoking because:

A. the risk for potentially dangerous thromboembolic episodes increases

Response Feedback:

Oral contraceptives and other drugs containing oestrogens, progestins, or combination products increase the risk of deep vein thrombosis and subsequent pulmonary embolism. Smoking does as well, and patients on both have greatly increased risks.

Q. The most specific symptom for prostatic cancer is:

A. Blood in urine

Response Feedback:

Blood in the urine is the most specific symptom /sign of prostatic cancer until the very late symptom of bone pain. While some individuals with prostatic cancer will experience the same type of urinary hesitance, decreased urinary stream and nocturea experienced by men with BPH, prostatic cancer does not necessarily come along with those because the growth may be on the outside of the prostate, and not affect flow through the urethra.

Since blood in the urine is not always seen in prostate cancer and because that can be seen quite late in the course of the cancer, the clinician should instead rely on the risk factors such as increasing age, and family history. Regular prostate checkups involving digital assessment and analysis of the prostate specific antigen should be performed as males increase in age.

Q. A post-menopausal woman is to receive short-term hormonal replacement therapy to control her menopausal symptoms. Which of the following would the nurse include when teaching the woman about possible adverse effect of this therapy?

A. breakthrough bleeding

Response Feedback:

A possible adverse effect of short-term hormonal replacement therapy is breakthrough bleeding.

Q. It is extremely important that benign prostatic hyperplasia is treated because it can lead to:

A. renal failure

Response Feedback:

Benign Prostatic Hyperplasia (BPH) causes decreased flow through the urethra which will lead to decreased flow, urinary hesitance, dribbling and will eventually lead to fluid building up in the urinary bladder, the ureters and eventually the kidney. In animal models of unilateral urethral obstruction, total obstruction destroys the kidney in just a few days. TOTAL DESTRUCTION OF THE KIDNEYS IS POSSIBLE WITH BPH.

BPH is not normally associated with cancer, the P in the BPH is spelled and pronounced as prostate, (prostrate is to lie on the ground with head facing the ground and hands stretched. out.). Bone pain is a late symptom of prostatic cancer, and not BPH.

Q. Combination oestrogens and progestins are commonly used as oral contraceptives. The amount of oestrogens present in the pill will:

A. "trick" the hypothalamus into secreting low levels of gonadotropin-releasing hormone (GnRH)

Response Feedback:

The low, constant level of oestrogen and progesterone decreases hypothalamus secretion of GnRH, thus decreasing follicle-stimulating hormone (FSH). The decreased FSH normally does not reach the level necessary to stimulate follicular development, and therefore the woman does not ovulate. However, the 4 to 7 days the "sugar pills" are taken (placebo days) prompts the endometrium to slough off, and therefore menstruation occurs.

Another mechanism of action of all progesterone-containing contraceptives is inhibition of sperm penetration through the cervix into the uterus by decreasing the water content and increasing the viscosity of the cervical mucus.

Q. In a non-pregnant woman, the levels of the sex hormones (oestrogens and progesterones) fluctuate in a cyclical fashion until:

A. all of the ova are depleted

Response Feedback:

In a non-pregnant woman of child-bearing age, the levels of the sex hormones (oestrogens and progesterone) fluctuate in a cyclical fashion until all ova have been depleted.

During foetal life, females make all the ova they will ever have. Once menarche occurs, the non-pregnant female has hormonal fluctuations until only a few ova are left. This marks the beginning of the peri-menopausal time, where fluctuations become rather irregular, owing to the decreasing quality of the remaining ova. When all ova have been depleted, oestrogen and progesterone will decrease to the amount that can be produced by the adrenal cortex, and remain at a relatively constant level.

Extreme stress can interrupt the cyclic pattern of hormone production and ova release. For instance, extreme hunger, lack of body fat, extremes in exercise, and extreme emotional stress is a signal for the hypothalamus to temporarily stop the hypothalamus-pituitary-ovarian cycle. In that case, the levels of oestrogen and progesterone will decrease to the level produced by the adrenal cortex.

Q. Which of the following is associated with oestrogen receptor modulators?

A. hot flushes and vaginal bleeding

Response Feedback:

An oestrogen receptor modulator is sometimes given in a woman with a family history of breast or uterine cancer. They commonly cause hot flushes, leg cramps and vaginal bleeding.

Raloxifene is an oral selective oestrogen receptor modulator (SERM) that has estrogenic actions on bone and anti-estrogenic actions on the uterus and breast. It is used in the prevention of osteoporosis in postmenopausal women and for the prevention of breast cancer postmenopausal women at increased risk. Raloxifene is preferred over tamoxifen, as tamoxifen is associated with increased risk of uterine cancer and of cataracts.

Q. Testosterone is approved for use in:

A. treatment of breast cancers

Response Feedback:

The androgen (testosterone-like drug) Fluoxymesterone is occasionally used for the treatment of advanced breast cancer. The mechanism of the anti-cancer effects of these androgens in breast cancer is unclear, but may involve suppression of oestrogen receptor levels, alteration of hormone metabolism, and/or direct cytotoxicity.

Androgens are also approved for use in male androgen deficiency and in cases of debilitation and severe weight loss.

Q. To achieve erection, a person taking sildenafil (Viagra) would require:

A. sexual stimulation

Response Feedback:

Sildenafil (Viagra) increase nitrous oxide levels in the corpus cavernosum, causing vascular relaxation and promoting blood flow into the corpus cavernosum. Sexual stimulation is still necessary.

The most common side effect of sildenafil is extreme headache/migraine (85%).

Q. A potentially deadly drug-drug interaction can occur if a PDE5 inhibitor (sildenafil, tadalafil, or vardenafil) is combined with:

A. organic nitrites

Response Feedback:

This is especially problematic due to the fact that both substances (sildenafil and amyl nitrite) are used for recreational purposes. Sildenafil, also known as Viagra, is a medication used to treat erectile dysfunction and pulmonary arterial hypertension. Amyl nitrite is a drug that relaxes smooth muscles throughout the body, therefore dilating the blood vessels and decreasing blood pressure.

Q. The parathyroid glands produce parathyroid hormone (PTH), which is important in the body as:

A. a regulator of calcium

Response Feedback:

PTH is secreted by the parathyroid glands in response to decreased calcium in the blood. PTH then sequesters more calcium from the diet, helps conserve calcium at the level of the kidneys and helps break down bone to increase the calcium levels. (What is the name of the drug that mimics PTH again?)

Calcitonin is another hormone released from the parathyroid glands and acts to decrease calcium concentration. Given the fact that humans have two hormones regulating serum calcium concentration. Serum calcium normally stays within a fairly close to normal range and serum calcium by itself is not diagnostic of any disorder.

Answer to above question: Teriparatide mimics parathyroid hormone (PTH). as it is an analogue of the active portion of human parathyroid hormone (PTH). Endogenous PTH is the primary regulator of calcium and phosphate metabolism in bone and kidney. PTH increases serum calcium, partially accomplishing this by increasing bone resorption. Thus, chronically elevated PTH will deplete bone stores. However, intermittent exposure to PTH will activate osteoblasts more than osteoclasts. Thus, once-daily injections of teriparatide have a net effect of stimulating new bone formation leading to increased bone mineral density

Q. A drug of choice for the treatment of postmenopausal osteoporosis would be:

A. the bisphosphonate alendronate

Response Feedback:

The drug of choice for the treatment of postmenopausal osteoporosis would be the bisphosphonate alendronate.

The bisphosphonates act to slow or block bone resorption. They lower serum calcium levels but do not inhibit normal bone formation and mineralisation. There are normally few side effects; however they are contraindicated in pregnancy due to their potential to cause foetal abnormalities.

Teriparitide is the other drug you need to remember for osteoporosis. It is a recombinant form of parathyroid hormone. It is an effective anabolic treatment that activates osteoblasts.

Q. The medication that mimics the body's own parathyroid hormone is called:

A. Teriparitide

Response Feedback:

The medication that mimics the body's own parathyroid hormone is teriparitide. Strontium ranelate is a medication that is second line or even third line treatment of osteoporosis now that we know it increases risk of myocardial infarction. The biphosphonates are the first line therapy for OP. Prednisone and other glucocorticoids (cortisol like drugs) CAUSE OP and other bone disorders like osteonecrosis.

Q. Of the following nutrient combinations, which is most important in bone health?

A. Calcium and Vitamin D

Response Feedback:

Vitamin D and calcium are most important for bone health.

Vitamin D is actually a secosteroid (closer to a hormone) that can be made from cholesterol by the skin being exposed to UV light, while another form of vitamin D is available from some foods like some vegetables and fish. Different forms of vitamin D are responsible for enhancing intestinal absorption of calcium, iron, magnesium, phosphate and zinc. The absence of vitamin D during growing years of a child manifests as the disorder called Rickets. Rickets is a softening of the bone that results in bone malformation. Vitamin D remains important in bone health throughout the person's life.Vitamin D deficiency leads to a DECREASE in bone mineralisation,

Question:

Which of the following is not true about vitamin D?

Deficiency in the vitamin leads to an increase in bone mineralisation

It is absorbed via the gastrointestinal system from vegetable products and some fish

It is essential in the regulation of calcium and phosphorous in the body

It can be 'made' as long as the client has enough exposure to UV rays.