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Adverse effects

Don't memorize drugs in these lectures, just understand the concept.

Previously, we talked about the therapeutic index (TI), toxicity and their importance. Now we will talk about the adverse effects: what are they, why do they occur, and who is more susceptible to them.

Adverse effect:

Adverse effects are undesired effects that may be unpleasant or even dangerous.

**There is no drug without a side effect.

**Some people are more susceptible to side effects because of genetics.

Adverse effects happen because:-

1. The drug may have other (side) effects on the body besides the therapeutic effect. (due to drug-drug interactions).
2. The patient is sensitive to the drug. The body could form antibodies for certain drugs which were taken before by the patient and if he/she takes the same drug again it will cause side effects. There is no link between this reason and the receptors.
3. The patient is taking too much or too little of the drug.
 - Too little indicates that there are many receptors but a very low level of the drug in the case of antagonist. (review up regulation in the previous lecture)
 - Too much indicates to tolerance* in the case of agonists.

A good example is when an antibiotic is prescribed, you should finish all the course and not miss any single dose because the body contains both good

bacteria (normal flora) which are too sensitive to antibiotics and bad bacteria which are less sensitive, if you take a little amount of the antibiotic the good bacteria will be killed but the bad bacteria will survive and cause side effects because you took too little amount of the drug.

*Tolerance occurs mostly for CNS drugs (psychoactive drugs) like analgesics, morphins and heroin.

Types of adverse effects

1. Augmented pharmacological effects

These effects are usually dose-related and/or pharmacological (related to receptors). They are seldom fatal and relatively common. Usually happen because of:

A. Non-specific binding of the drug to a receptor.

B. Receptor has another effect somewhere else in the body, this reason is more common than the previous one, a good example for that is when a patient takes an anti-hypertension drug, he/she will suffer from headache (side effect) because of a transient ischemia in the brain . ضعف التروية الدموية للدماغ .

2. Bizzare effects (Idiosyncratic = without a reason)

Are effects that occur **unpredictably**, often have a high rate of morbidity and mortality. Their reasons are still unknown and often depend on the person taking the drug. They are not related to neither pharmacology nor the drug effect.

Example: a patient is given a pigment, she got into a coma then died. (she didn't have an allergy)

*Penicillin receptors are on the bacterial cell walls and it has a wide therapeutic index.

3. Chronic effects

Adverse effects that happen only after **prolonged** treatment and not with single doses.

Example: an ex-breast cancer patient takes Tamoxifen (again, drugs are not to be memorized now) which is an estrogen receptor antagonist/modulator that inhibits growth in the breast but stimulates growth in the uterus. She must take it for five years **exactly** (no even 5 years and 1 month); so she doesn't develop endometrium (uterus) cancer which is a chronic side effect in this case.

Example: a patient should not take cortisone more than six months otherwise osteoporosis may occur (chronic side effect).

****Chronic side effects are common and they are related to the accumulation of the drug.**

4. Delayed effects

Delayed side effects are adverse effect that occur remote from treatment, either in the children of the pregnant treated patients, or in the treated patient years after treatment.

Example: an ex-cancer patient is cured, after five years he got another cancer because of the old cancer treatment (these medications are called carcinogenic).

5. End of treatment effects

These effects occur when the drug is stopped suddenly and not tapered off (recall last lecture).

Example: Propranolol is a β_1 blocker, it's an antagonist, the receptors will increase their sensitivity and number to increase the effect of the drug (up regulation). If it stopped abruptly, adverse effects happen (such as angina or chest pain, tachycardia and cerebral hemorrhage).

What are the risk factors?

- Gender (women are more susceptible to adverse effects more than men, sorry ladies!)

- Being pregnant, because the body somehow changes the way it deals with drugs. The risk also includes the fetus.
- Breast feeding, including babies.
- Age (being very old or very young), infants are very susceptible to side effects, -16s (pediatric medicine patients) and +65s (geriatric medicine patients) are also very susceptible to side effects.
- Genetics (hereditary factors)
- Disease states which may affect drug absorption, metabolism and/or elimination. (example: a patient has liver cirrhosis, he/she may not be able to fully detoxificate drugs or toxins). Remember that liver is the graveyard of drugs.

THE END

I do apologize in advance for any mistakes or not fully explained points.

You've done such a great job so far, pat yourselves on the back and keep up the good work 😊