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PAEDIATRIC AND GERIATRIC PHARMACOLOGY

SUNALI MEHTA

Pediatric, the elderly and pregnant women are termed as vulnerable groups in pharmacology and the reason being that these groups react differently to the drugs.

Drug sensitivity in

Young children : due to organ immaturity

Elderly : organ system degeneration

Pregnant women: change in the body to compensate for the growing fetus.

Pediatrics:

All patients under the age of 16

A. Pharmacokinetics:

Absorption

Slowed gastric emptying

Reduced gastric acidity

Poor peripheral tissue perfusion

Decreased skeletal muscle mass.

Distribution:

Higher water/fat ratio

Lipid membranes more permeable especially blood brain barrier

Protein binding will be reduced.

Metabolism:

Reduced in neonates

Takes 3 years for the child's liver to develop into an adult's liver and have the same amount of enzymes

Older children may have relatively greater liver activity

Excretion:

Neonates diminished Glomerulus filtration and tubular excretion hence reduced clearance of drugs

Older children same as adults.

B. Pharmacodynamics:

Some drugs will have a reduced effect in neonates e.g. digoxin

Others may have an increased effect in neonates e.g. CNS depressants.

C. Doses in Neonates and children:

Calculations earlier were based on age and weight but these were not very accurate hence now calculations are based on the BSA.

Age : Young's rule

$(\text{Child's age} / (\text{child's age} + 12)) \times \text{adult dose} = \text{pediatric dose}$

Body weight : Clarke's bodyweight rule:

$\text{Pediatric dose} = (\text{child's weight} / 68) \times \text{adult dose}$

BSA : Clarke's BSA rule:

$\text{Pediatric dose} = (\text{surface area of child (m}^2) / 1.73) \times \text{adult dose.}$

Pediatric clinical management:

Assessment

Planning

Implementation

Evaluation.

Elderly:

Adverse reactions can occur in the elderly mainly because:

1. Polypharmacy
2. Altered pharmacokinetics: absorption is slower; distribution is altered i.e. reduced protein binding, reduced blood flow to the organs, increased proportion of fat and reduced proportion of water. Elimination of the drug is reduced ; GFR and Tubular excretion is reduced, liver metabolism reduced
3. Altered pharmacodynamics: prolonged activity of the drug, less sensitivity to some drugs
4. Disease
5. Homeostatic mechanisms.
6. Compliance : Biological effects of aging , social circumstances of the elderly, problems caused by the health team, consequences of non compliance and possible solution.
7. Psychosocial factors
8. Use of OTC drugs.

Pregnancy:

Altered Pharmacokinetics:

Absorption: Slowed GI motility as a result of which more drug can be absorbed.

Interference with the activity of the drug like early morning sickness

Distribution: increased plasma volume causing haemodilution leading to reduced concentration of drugs. More acidic drugs available since there is a decrease in the concentration of albumin. Lower levels of basic drugs since there is an increase in the concentration of α – acidglycoproteins.

Metabolism and elimination: Renal elimination remains unaltered. Accelerated clearance of drugs in the 3rd trimester, liver metabolism may be enhanced by progesterone and hence there is enhanced clearance of drugs.

Key point:

Take drugs only if necessary as they may cross the placenta and affect the fetus.

Type of effect may vary depending on the drug, dosage, duration and the time of exposure during pregnancy.

First 8 weeks : major organ development : congenital malformations or early miscarriage.

Later in pregnancy : Growth retardation, prematurity, affect labor

Teratogen are agents which may cause malformation in a fetus.

Drugs most likely to cross the placenta are small and lipid soluble.

Drugs may affect the infants via breast milk:

Some drugs affect milk production for e.g. oestrogen

The drug might enter the milk in high enough quantity to affect the infant.

Factors that affect amount of drug into the milk is maternal blood concentration, extent of transfer, volume of breast milk consumed, percentage of the drug absorbed by the infants gut.