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Diploma in Pharmacy 2nd Year
Pharmacotherapeutics
Experiment

To calculate dose in paediatrics and geriatrics under various pathological conditions.

Aim:

To calculate dose in paediatrics and geriatrics under various pathological conditions.

Reference :

‘ Dr. Gupta G.D. , Dr. Sharma Shailesh, Dr. Sharma Rahul Kumar, “Practical Manual of Pharmacotherapeutics” Published by Nirali Prakashan, Page no 90 - 94

Theory :

Paediatric Dose Calculations: The doses for infant and children are calculated on the basis of the following parameters:

1) **Dose Calculations Based on Age:** Dose adjustments are generally made in accordance with the patient's age. With increasing age, patients may experience certain changes in their pharmacokinetic parameters. Normally, in infants the drug elimination mechanism (including drug metabolism and excretion) is less efficient, however, their efficiency increases with age which further declines after they attain an age of 65 years or above. In addition to age, there are also other parameters which affect dose adjustments. Hence, it is advisable to monitor the response patient produces after some more time of adjusting dose.

   The dose for paediatrics based on their age can be calculated using the following formulas.s

i) Dilling's Rule

Child's dose = Age in years/20 × Adult dose

Example 1: If the adult dose is 60mg and the age of the child is 6 years, what will be the dose for the child?

Solution: Dose for the child = $\frac{6}{20}$x60 = $\frac{6}{20}$x60 = 18mg

ii) Fried's Rule

Infant's or child's dose= $\frac{\text{Agein months}}{150}$ x Adultdose

Example 2: What should be the dosage for a 15-month-old child if the adult dose is 30mg?

Solution: Dose for an infant= x30mg = $\frac{1}{10}$ x30mg = 3mg

iii) Young's Rule

Childdose = $\frac{\text{Agein years}}{\text{Agein years+12}}$ x Adultdose

Example 3: If the adult dose is 60mg and the age of the child is 4 years, what will be the dose for the child?

Solution: Dose for the child = $\frac{4}{4+12}$ ×60 = $\frac{4}{16}$ ×60 = $\frac{1}{4}$×60

= 15mg

iv) Cowling's Formula

Child's dose = $\frac{\text{Age in Years +1}}{24}$x Adult dose

v) **Bastedo's Formula**

$$\text{Child's dose} = \frac{\text{Age in Years} + 3}{30} \times \text{Adult dose}$$

2) **Dose Calculations Based on Body Weight:** In children and obese patients, the dose adjustments are based on weight. The dosing regimen also changes along with any alternations in the volume of distribution which depends on the total quantity of water present in the body and therefore extracellular fluids are related to the body weight.

Hence, the volume of distribution changes along with alternations in body weight. The proportion of body fat is greater in obese patients. whereas the ratio of body water and lean body weight to total body weight is much smaller.

The dose for paediatrics based on their body weight can be calculated using the Clark's Formula

$$\text{Child's dose} = \frac{\text{child's weight (kg).}}{70} \times \text{adult dose}$$

Example 4: If the adult dose is 60mg and the weight of the child is 14kg. what will be the dose for the child?

Solution: Dose for the child = $\frac{14}{70} \times 60 = 12\text{mg}$

3) **Dose Calculations Based on Body Surface Area:** The Body Surface Area (BSA) method of calculating drug doses is widely used for two types of patient groups, ie, cancer patients receiving chemotherapy and paediatric patients.

In the latter however neonates are the exceptions who are usually dosed on a weight basis considering their age and a variety of biochemical. physiologic, functional, pathologic, and immunologic factors

The calculation of child's dose according to the body surface area is more appropriate rather than the methods based on age

This method is more complicated than the methods based on age but tablets have been provided by which dose for a child can be calculated. This method is based on the following formula

$$\text{Child's dose} = \frac{\text{Surface area of child}}{\text{Surface area of adult}} \text{x100mg}$$

Based on the average adult BSA of 1.73m^2, table 4 shows the approximate relation between the body weight and surface area of average body dimensions.

Table 4: Approximate Relation of Surface Area and Weights of Individuals of Average Body Dimension

Kilograms	Pounds	Surface Area in Square Meters	Percentage of Adult Dose
2	4.4	0.15	9
3	6.6	0.20	11.5
4	8.8	0.25	14
5	11.0	0.29	16.5
6	13.2	0.33	19
7	15.4	0.37	21
8	17.6	0.40	23
9	19.8	0.43	25
10	22.0	0.46	27
15	33.0	0.63	36
20	44.0	0.83	48

25	55.0	0.95	55
30	66.0	1.08	62
35	77.0	1.20	69
40	88.0	1.30	75
45	99.0	1.40	81
50	110.0	1.51	87
55	121.0	1.58	91

Example 5: Calculate the dose for a child having BSA 0.83m².

Solution: Child's dose = $\frac{0.83m^2.}{1.73m^2.}$ x100mg = 47.97 or 48mg

According to table 2.2, a BSA of 0 83m² represents 48% of the average adult BSA of 1.73m², thus, the child dose would be 48% of the usual adult dose

100mg × 0 48 = 48 mg dose for child

Geriatric Dose Calculations:

1) Geriatrics, often known as geriatric medicine, is the field that deals with treating elderly patients.
   i) As people age functional capacities of most organ systems decline.
   ii) As people age, significant changes in medication responsiveness occur.
2) Before the age of 30, the majority of age-related physiological processes reach their peak, followed by a gradual linear decline.
3) As people age, physiologic capacity and function decline cumulatively and increasingly severely:
   i) Kidney function is a key factor to consider when prescribing medication to elderly patients since decreased function leads to decreased drug elimination.

ii) Renal blood flow declines by over 1% annually after the age of 30, resulting in a cumulative decline in most people between the ages of 60 and 70 of about 30% to 40%, a value that is significantly higher in the elderly.

iii) The dose should be low at the initial stage and the dose adjustment should need to be monitored.

4) Other common characteristics of elderly medicine use include:

i) The long-term use of maintenance drugs,

ii) The requirement for multidrug therapy, which increases the risk of drug interactions and adverse drug effects.

iii) The difficulties in the patient compliance are due to:

a) Impaired cognition,

b) Confusion over the various dosing schedules of multiple medications,

c) Depression or apathy,

d) Economic reasons.

The doses for geriatric are calculated on the basis of the following parameters

1) Dose Calculation Based on Body Weight: it is expressed as a drug/body weight, such as mg or mcg/kg it can be used for both paediatric and geriatric patients. A useful equation in this aspect is:

Patient's dose(mg) = Patient's weight (kg) x Drug dose (mg)/1kg.

(Units can be adjusted accordingly)

2) **Dose Calculation Based on Body Surface Area:** Body Surface Area (BSA) is applicable to two different patient groups:

i) Cancer patients with chemotherapy.

ii) Paediatric patients, excluding neonates, who are often dosed depending on body weight while considering physiological, pathological, and immunological factors

The BNF and a number of other reference text books, including Martindale, suggest dosage calculation according to BSA because total dose is not directly proportionate to weight of the body but is more accurately proportional to BSA in children

A useful equation in this regard is below. Patient's dose = Patient's BSA (m^2)/1 73 m^2

There are two ways to determine the BSA:

i) By using available readymade Nomograms for BSA, or

ii) By using Mosteller equation (197), as below

Patient's BSA (m^2) = √patient's height (cm) x Patient's weight (kg)/3600

Medication dosages for paediatric kids (either administered orally or parentally) must be carefully calculated using the relevant reference sources.

It is commonly acknowledged that the dose requirements per unit of body weight are generally higher for children than for adults. Drug dosage guidelines have been produced based on factors such as age, weight, and body surface. The dose calculation based on body surface area is the most reliable among these principles because the total dosage is thus not directly proportional to the body weight but rather seems to be more nearly so. J.A. Lack proposed a more accurate guideline for dosage calculation in children, i.e, up to 30 kg, a child's drug dose may be (weight ×2)% of an adult dose; over 30 kg, (weight + 2)% of an adult dose and demonstrated that none of these rules had been precise and easy to follow in daily life.

Result : The dose in paediatrics and geriatrics under various pathological conditions is calculated

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