Approach to Optimize Pharmacological Treatment in Children

Hugo Juárez Olguín

Keywords
children, drugs, pharmacokinetic, pharmacodynamics, therapeutic drug monitoring

Pharmacological Treatment of Children
The different stages of life are marked by processes of immaturity, maturity, and aging where the body undergoes different changes such as anatomical, physical, and biochemical. These processes alter the pharmacokinetics of drugs, individual comorbidities, and the patient’s nutritional status. Hence, it is extremely important to know the pharmacokinetics of drugs being administered to patients in order to individualize their use in medical therapeutics. During the pharmacological treatment in children, it should be noted that the physiological changes that occur in the pediatric age not only influence the drug distribution but also the absorption, biotransformation, and elimination and therefore the therapeutic response. So, unintentional overdose in this population is more common, because the pediatrician usually does not consider these changes when indicating a medication.

Unfortunately, only the body weight is considered in administering the dose of a drug with the belief that the therapeutic response obtained would be good and would be similar in different groups of patients, without considering the homeostatic vision of the organism and biological variability. Pharmacological success is evaluated based on empirical test and error criterion; therefore, the pharmacological dose can be increased or decreased depending on the response obtained. It is not generally questioned whether the therapeutic dose is adequate to achieve and maintain plasma levels within the therapeutic range, which is very important to ensure the obtaining of the required pharmacological goal.

Pediatric stage embraces the period that goes from birth to adolescence and this entails the possession of characteristics very different among individuals derived from the effect of growth and development. Undoubtedly, these changes influence on drug distribution and response. The body composition and the processes of biological and physiological maturation constitute important variables worthy of consideration in the effort to adequately satisfy the therapeutic necessities of all the age groups, since different formulations are required to achieve optimum therapy which commences by ensuring the rational use of drugs.

Technological advances in the last decades, of which we are a living witness, have endowed us with the facilities to painstakingly analyze biological samples and thus give way to a potential progress in the study of pharmacokinetics and pharmacodynamics. From this knowledge, it becomes clear that the body is a dynamic model and thus brings to limelight the necessity to individualize treatment regimens based on parameters of each and every one, which in the past were not believed to be important.

There are instruments that contribute to optimize drug management and safety in pediatric population as recommended even by the World Health Organization. The fundamental point of these instruments is the application of drug monitoring strategies that would contribute on ensuring the safety of the patients and on improving treatment schemes to guarantee the use of drugs in safe and effective manner. However, there are some important situations that must be taken into account in order to carry out therapeutic drug monitoring (TDM): When drugs with narrow therapeutic range are administered; due to lack of desired pharmacological response; for the presence of toxicity manifestations using therapeutic doses; to adjust doses to conditions that alter pharmacokinetics; to adjust doses in specific physiological conditions for example hepatic or renal dysfunction; when drugs are administered with a close dose–response relationship; and drugs that follow a nonlinear

---

1 Laboratory of Pharmacology, National Institute of Pediatrics and Faculty of Medicine, National Autonomous University of Mexico, Mexico City, Mexico.

Received 21 February 2019; received revised 20 June 2019; accepted 25 June 2019

Corresponding Author:
Hugo Juárez Olguín, Laboratorio de Farmacología, Instituto Nacional de Pediatría, Avenida Imán N 1, 3rd piso Colonia Cuicuilco CP 04530, Mexico City, Mexico.
Emails: juarezol@yahoo.com; adrianos27@hotmail.com

Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (http://www.creativecommons.org/licenses/by-nc/4.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage).
Optimization of Drug Prescribing in Children

One of the research lines that cropped up, for its need and nature, is pediatric clinical research. Undoubtedly and due to its characteristics, this research area has turned out to be extremely interesting but at the same time difficult for many researchers due to restrictions, especially the ethical aspects. These restrictions arose when it becomes obvious that during the phases of pharmacological research, the groups of population involved in the final work are special groups such as the pediatric population, pregnant women, and the elderly population. By nature, these population groups have lesser pharmacological therapeutic alternatives when compared with normal population.

In their part, the pharmaceutical industries consider these special groups in their research works only when they are completely sure of a market for the sale of their products. The lack of studies backing up the safe use of drugs in this special groups has cornered the specialists attending these patients into the surveillance of dedicated disease. 8

It is necessary to emphasize that the pediatric population is vulnerable to presenting adverse reactions to medications due to the physiological characteristics of the developmental stage and the changes in the pharmacokinetic constants and therapeutic effect, compared to the adult age. Because children have greater adverse reactions compared to adults, it is necessary to perform pharmacovigilance in this population. Even consider that adverse effects to medications can occur even in the breastfeeding stage, and that drug interactions may influence the presence of adverse reactions. Although there is little information, however, it has been noted TDM has contributed in the surveillance of dedicated disease. 10

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: I thank to Instituto Nacional de Pediatría for the economical support given for the publication of this article.

ORCID iD
Hugo Juárez Olguín https://orcid.org/0000-0002-1405-1728
References

1. Juárez Olguín H, Lares Asseff I. Pharmacology for the fetus and the newborn. In: Juarez Olguin H, ed. Optimization of Drugs Prescribing in Children. New York, NY: Nova Science; 2017: 91-112.

2. Juárez Olguín H, Calderón Guzmán D, Punzo Soto M. How is the LADME process of drugs in children? In: Juarez Olguin H, ed. Optimization of Drugs Prescribing in Children. New York, NY: Nova Science; 2017:75-90.

3. Downes KJ, Dong M, Fukuda T, et al. Urinary kidney injury biomarkers and tobramycin clearance among children and young adults with cystic fibrosis: a population pharmacokinetic analysis. J Antimicrob Chemother. 2017;72(1):254-260.

4. Juárez Olguín H, Punzo Soto M, Juárez Tapia B. Therapeutic drug monitoring in children. In: Juarez Olguin H, ed. Optimization of Drugs Prescribing in Children. New York, NY: Nova Science; 2017:133-154.

5. Kang JS, Lee MH. Overview of therapeutic drug monitoring. Korean J Intern Med. 2009;24(1):1-10.

6. Sourbron J, Chan H, Wammes-van der Heijden EA, et al. Review on the relevance of therapeutic drug monitoring of levetiracetam. Seizure. 2018;62:131-135.

7. Assadi F, Sharbaf FG. Practical considerations to drug dosing in children with acute kidney injury. J Clin Pharmacol. 2016;56(4):399-407.

8. Juárez Olguín H, Reyes González F, Flores Pérez J. Pharmacovigilance and pharmacoepidemiology in children. In: Juarez Olguin H, ed. Optimization of Drugs Prescribing in Children. New York, NY: Nova Science; 2017:189-202.

9. Lega S, Bramuzzo M, Dubinsky MC. Therapeutic drug monitoring in pediatric IBD: current application and future perspectives. Curr Med Chem. 2018;25(24):2840-2854.

10. Schoretsanitis G, Paulzen M, Unterecker S, et al. TDM in psychiatry and neurology: a comprehensive summary of the consensus guidelines for therapeutic drug monitoring in neuropsychopharmacology, update 2017; a tool for clinicians. World J Biol Psychiatry. 2018;19(3):162-174.

11. Juárez Olguín H, Flores Perez C, Ramírez Mendiola B, Coria Jimenez R, Sandoval Ramirez E, Flores Pérez J. Extemporaneous suspension of propafenone: attending lack of pediatric formulations in Mexico. Pediatr Cardiol. 2008;29(6):1077-1081.

12. Juarez Olguin H, Camacho Reyes L, Roldan Arce A, Calderon Guzman D. Treatment of pulmonary arterial hypertension using an extemporaneous formulation of sildenafil in Mexican children. Pediatr Cardiol. 2015;36(5):1019-1023.