Prescribing for Children

Children, and particularly neonates, differ from adults in their response to drugs. Special care is needed in ensuring the drug prescribed is appropriate and that the correct dosage is given, especially in the neonatal period.

Factors affecting drug disposition in children

Oral absorption
- Variable gastric and intestinal transit time: in young infants, gastric emptying time is prolonged and only approaches adult values at around 6 months of age. In older infants, intestinal hurry may occur.
- Increased gastric pH: gastric acid output does not reach adult values until the second year of life.
- Other factors: gastrointestinal contents, posture, disease states and therapeutic interventions, such as drug therapy, can also affect the absorption process.

Distribution
- Increased total body water: as a percentage of total body weight, the total body water and extracellular fluid volume decrease with increasing age. Neonates require higher doses of water-soluble drugs, on an mg/kg basis, than adults.
- Decreased plasma protein binding: plasma protein binding in neonates is reduced as a result of low levels of albumin and globulins and an altered binding capacity. High circulating bilirubin levels in neonates may displace drugs from albumin.

Metabolism
- Enzyme systems mature at different times and may be absent at birth, or present in considerably reduced amounts.
- Altered metabolic pathways may exist for some drugs.
- Metabolic rate increases dramatically in children and is often greater than in adults. Compared with adults, children may require more frequent dosing or higher doses on an mg/kg basis.

Excretion
Complete maturation of renal function is not reached until 6-8 months of age.

Route of administration and drug regimes
- Compliance in children is influenced by the formulation, taste, appearance and ease of administration of a preparation.
- Prescribed regimens should be tailored to the child’s daily routine. Where possible, treatment goals should be set in collaboration with the child.
- Whenever possible, the use of products which avoid the need for administration during school hours should be considered (eg, modified-release preparations or drugs with long half-lives). When administration at school is unavoidable, consideration should be given to prescribing and supplying the school time dose in a separate labelled container.
- Most schools will request written permission from parents to administer the medicine, or may ask parents to return to school to give the medicine themselves.[1]
- Whenever possible, painful intramuscular (IM) injections should be avoided in children.

Product licence
- Where possible, medicines for children should be prescribed within the terms of the marketing authorisation (product licence). However, many children may require medicines not specifically licensed for paediatric use.
The Medicines Act 1968 and European legislation make provision for doctors to use medicines in an 
off-label capacity or to use unlicensed medicines. However, individual prescribers are always 
responsible for ensuring that there is adequate information to support the quality, efficacy, safety and 
intended use of a drug before prescribing it.

Although medicines cannot be promoted outside the limits of the licence, the Medicines Act does not 
prohibit the use of unlicensed medicines. It is recognised that the informed use of unlicensed 
medicines or of licensed medicines for unlicensed applications ('off-label' use) is often necessary in 
paediatric practice.

Prescription writing

- Inclusion of age is a legal requirement in the case of prescription-only medicines for children under 12 
  years of age, but it is preferable to state the age for all prescriptions for children. It is particularly 
  important to state the strengths of capsules or tablets.
- Although liquid preparations are particularly suitable for children, they may contain sugar which 
  encourages dental decay. Sugar-free medicines are preferred for long-term treatment. Many children 
  are able to swallow tablets or capsules and may prefer a solid dose form; involving the child and 
  parents in choosing the formulation is helpful.
- When a prescription for a liquid oral preparation is written and the dose ordered is smaller than 5 mL, 
  an oral syringe will be supplied.
- Parents should be advised not to add any medicines to the infant's feed, since the drug may interact 
  with the milk or other liquid in it; moreover, the ingested dosage may be reduced if the child does not 
  drink all the contents.

Dosages

- Children are not mini-adults. Paediatric doses should be obtained from a paediatric dosage reference 
text and not extrapolated from the adult dose.
- When considering drug use in children, the following age groups should be used: Preterm (born before 
  37 weeks), neonate (birth to 1 month), infant (1 month to 12 months), child (1 to 12 years) and 
  adolescent (12 to 18 years).
- Unless the age is specified, the term 'child' in the British National Formulary (BNF) includes persons 
  aged 12 years and younger.

Dose calculation

- Children's doses may be calculated from adult doses by using age, body weight, or body surface area, 
or by a combination of these factors. The most reliable methods are those based on body surface 
area.
- Body weight may be used to calculate doses expressed in mg/kg. Young children may require a higher 
dose per kg than adults because of their higher metabolic rates.
- Other problems need to be considered. For example, calculation by body weight in the overweight 
child may result in much higher doses being administered than necessary; in such cases, dose 
should be calculated from an ideal weight, related to height and age (there is a simple table at the back 
of the Children's BNF - see under 'Further reading & references', below).
- Body-surface area estimates are more accurate for calculation of paediatric doses than body weight 
since many physiological phenomena correlate better to body surface area.
- Body surface area may be calculated from height and weight by means of a nomogram or using the 
  Body Surface Area (BSA) Calculator although other paediatric drug calculators are available. [2] The 
  Children's BNF uses the Boyd calculation here.

Adverse drug reactions

Adverse drug reaction profiles in children may differ from those seen in adults. Doctors and pharmacists should 
report suspected adverse drug reactions to the Medicines and Healthcare products Regulatory Agency (MHRA), 
even if the product is being used in an 'off-label' manner or is an unlicensed product. Identification and reporting of 
adverse reactions to drugs in children are particularly important because:

- The action of the drug and its pharmacokinetics in children (especially in the very young) may be 
different from that in adults.
- Drugs are not extensively tested in children.
Many drugs are not specifically licensed for use in children and are used 'off-label'.
Suitable formulations may not be available to allow precise dosing in children.
The nature and course of illnesses and adverse drug reactions may differ between adults and children.

Safety in the home

Patients must be warned to keep all medicines out of the reach of children. All solid dose and all oral and external liquid preparations must be dispensed in a child-resistant container unless:

- The medicine is in an original pack or patient pack such as to make this inadvisable.
- The parent will have difficulty in opening a child-resistant container.
- A specific request is made that the product shall not be dispensed in a child-resistant container.
- No suitable child-resistant container exists for a particular liquid preparation.

All unused medicines should be returned to a supplier for destruction.

Further reading & references

- Medicines adherence: involving patients in decisions about prescribed medicines and supporting adherence; NICE Clinical Guideline (January 2009)
- Electronic Medicines Compendium (eMc)
- British National Formulary for Children; NICE Evidence Services (UK access only)

1. Managing Medicines in Schools and Early Years Settings; Dept of Health, March 2005

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