Pediatric Pharmacotherapy

A Monthly Newsletter for Health Care Professionals
Children's Medical Center at the University of Virginia

Volume 4 Number 3 March 1998

Helping Families Avoid Accidental Poisonings

Marcia L. Buck, Pharm.D.

March 15th-21st has been designated as Poison Prevention Week for 1998. The theme of this year's campaign is "Poison Proof Your Home."[1] This month is an ideal time to review methods for educating families in your practice to avoid accidental poisonings.

While most clinicians target poison prevention strategies at parents of children just beginning to walk, recent evidence suggests a much broader educational scope is needed to avoid accidental, as well as intentional, poisonings.[2] In fact, poison prevention education should be considered a part of family guidance from the prenatal visit through adolescence.

Poison Exposures During Childhood

In their 1996 annual report, the American Association of Poison Control Centers identified a total of 1,442,899 toxic exposures in children less than 19 years of age.[3] Of those exposures, 74 resulted in death. In addition to the morbidity and mortality associated with poisonings, there are significant medical costs involved. Annual patient charges at a single urban teaching hospital have been estimated to be as high as 1 million dollars for the management of these children.[4]

The majority of accidental poisonings reported in the United States continue to occur in children under 6 years of age. In 1996, 1,137,295 poisonings involving children less than 6 were documented. This figure represents 52.8% of the total number of exposures reported in all ages.[3]

Over the past 20 years, significant reductions have been noted in the number of deaths due to household chemicals and aspirin ingestions in young children. In 1994, the National Center for Health Statistics reported only 1 childhood death from accidental aspirin poisoning. The Poison Prevention Packaging Act of 1970, which mandated the use of child-resistant caps for many products, has been largely responsible for this decline.[1]

Despite these successes, there are still areas for improvement. Iron ingestions continue to be one of the leading causes of morbidity and mortality from accidental poisoning in the preschool population. In 1995 alone, more than 22,000 iron ingestions were reported to poison control centers in the United States.[3,5]

Morse, Hardwick, and King[5] have published an enlightening account of a fatal iron ingestion occurring in the 13-month old sibling of a 3 year old who had been evaluated for iron poisoning just 12 hours earlier. In addition to providing a concise review of the management of iron overdose, this case highlights the need for health care providers to inquire about the presence of other children in the home when investigating any poison exposure.

Not all poisonings are the result of accidental ingestions by curious toddlers. When educating families about poison prevention, health care providers should also provide information about the safe use of both prescription and over-the-counter (OTC) medications in children.

Acetaminophen is one of the most commonly misused medications during childhood. It has been available without a prescription for many years and is marketed in a variety of dosage formulations. Most parents feel "comfortable" with administering acetaminophen for pain or fever, but studies have repeatedly shown that a large percentage of careproviders administer inappropriate doses.[6,7]

In their review of acetaminophen toxicity in children resulting from the administration of multiple supratherapeutic doses, Heubi and colleagues[7] identified 47 cases of significant hepatic disease. Within this group of patients, 24

(55%) died, and three others received liver transplants. In the 44 cases where specific dosing information was available, records revealed that more than half of the patients (23/44) had been given adult dosage forms. The remaining cases were believed to have resulted from errors in calculating the appropriate dose or measuring liquid dosage forms.

Although acetaminophen is the most frequently implicated agent in case reports of toxicity from OTC medications, the risk of injury with other OTC products should not be overlooked. A recent case report from the University of Virginia Emergency Department by Sauder and colleagues described visual hallucinations in a 3 year old girl given two adult (20 mg/kg) doses of an oral OTC pseudoephedrine product for cold symptoms.[8]

Physicians, nurses, and pharmacists should work together to educate parents on the need to follow dosing guidelines on the package labeling for OTC products and emphasize the importance of administering age and weight-appropriate dosages. Parents of young children should also be given specific instructions about the use of a calibrated measuring device for liquids.

Counseling Families

The prenatal and early well child visits are ideal times to remind families of the importance of proper storage of medication, as well as other potentially harmful substances.[1,3] The following questions may help parents and other careproviders avert poisonings:

Are all medications, including vitamins and OTC products, in their original containers with child resistant caps? Multivitamin and mineral supplements, including prenatal vitamins, are particularly dangerous, since they may contain large amounts of iron.

Are all medications stored in a secure place out of the reach of children? The best way to store medications is in a locked cabinet. Don't wait until your child is walking to make your home poison proof.

Do you dispose of all medications you no longer need? Old medications should be flushed down the toilet.

Are all household and yard chemicals stored in their original containers? Most containers have child resistant caps and instructions on management of accidental ingestions.

Are these products in a secure place? Recommend that parents and careproviders check the garage, barn, and workshop areas as well as the house.

Do you know how to contact the poison control center and gain access to emergency medical personnel? These numbers should be kept near the phone. Make sure that baby-sitters and other family members know how to contact these places.

Despite public educational efforts, many families still fail to understand the role of a poison control center. In a recent study of 210 careproviders of children being evaluated in an emergency care center, 46% had failed to call a poison control center prior to coming to the hospital. In those cases in which a poison control center was not contacted, approximately 1/3 could have been managed at home.[9] The use of a poison control center to triage patients can dramatically reduce unnecessary visits to emergency medical centers.

Is syrup of ipecac available in your home? When used on the recommendation of a poison control expert, syrup of ipecac can significantly reduce the risk of injury from a poisoning.

Have you taken steps to poison proof the other places your child visits? Nearly one quarter of all accidental childhood poisonings occur outside the home.[1] Grandparents, baby-sitters, and friends should also make their homes safe for children.

Counseling Older Children and Adolescents

Discussing the risks of medications should not end with the advent of school. Older children, and particularly adolescents, are at risk from both accidental and intentional overdoses.

Children who are allowed to self-medicate must understand the risks of taking inappropriate amounts of medications, both prescription and OTC products. For example, children with asthma should understand the consequences of overuse of a beta-adrenergic agonist inhaler and demonstrate comprehension of the maximum safe number of inhalations.

Likewise, children taking OTC products without supervision must understand and comply with dosing instructions. In order to avoid unintentional overuse and possibly to reduce the likelihood of intentional overdose, teens should be aware of the significant risks associated with

OTC products, particularly acetaminophen and iron supplements.[2,10]

A survey to evaluate teens' knowledge of OTC product toxicity was published last year. The participants, 203 adolescents between the ages of 13 and 18, were asked to identify the potential for lethal overdose of several common OTC medications. There was only limited awareness of the lethality of overdoses with aspirin, acetaminophen, iron, antihistamines, camphor, methyl salicylate, and bismuth subsalicylate. Surprisingly, only 63% of the respondents were aware of the potential for acetaminophen to cause death, despite considerable attention to this issue in the lay press.[10]

Poison Prevention Week Displays

The need to educate families about the risk of poisoning continues throughout childhood. Poison Prevention Week activities at the University of Virginia are designed to complement your ongoing medication education program.

For more information, please encourage your patients and their families to visit the displays at the Primary Care Center and Barringer pharmacies from March 15th-21st. For additional educational supplies, please contact the Children's Medical Center Pharmacy at 982-0920 or the Poison Control Center at 924-0347.

References

1. Poison Prevention Week Council. 1997 Report on National Poison Prevention Week:1-31.
2. Berlin R. Poison prevention-Where can we make a difference? Acad Emerg Med 1997;4:163-4. Editorial.
3. Litovitz TL, Smilkstein M, Klein-Schwartz W, et al. 1996 annual report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. 1997;15:447-500.
4. Woolf A, Wieler J, Greenes D. Costs of poison-related hospitalizations at an urban teaching hospital for children. Arch Pediatr Adolesc Med 1997;151:719-23.
5. Morse SB, Hardwick WE, King WD. Fatal iron intoxication in an infant. South Med J 1997;90:1043-7.
6. Heubi JE, Barbacci MB, Zimmerman HJ. Therapeutic misadventures with acetaminophen: Hepatotoxicity after multiple doses in children. J Pediatr 1998;132:22-7.
7. Kearns GL, Leeder JS, Wasserman GS. Acetaminophen overdose with therapeutic intent. J Pediatr 1998;132:5-8. Editorial.
8. Sauder KL, Brady WJ, Hennes H. Visual hallucinations in a toddler: Accidental ingestion of a sympathomimetic over-the-counter nasal decongestant. Am J Emerg Med 1997;15:521-6.
9. Kelly NR, Kirkland RT, Holmes SE, et al. Assessing parental utilization of the poison center: An emergency center-based survey. Clin Pediatr 1997;36:467-73.
10. Huott MA, Storrow AB. A survey of adolescents' knowledge regarding toxicity of over-the-counter medications. Acad Emerg Med 1997;4:214-8.

Pharmacology Literature Review

Accuracy of Splitting Tablets

Although designed to address dosing practices in adults, this small-scale study has implications for many pediatric patients. The authors evaluated the accuracy of using a commercially available tablet-splitting device to cut a 25 mg hydrochlorothiazide tablet. Ninety-four volunteers split the tablets, which were then weighed for accuracy. Of the 1,752 halves created, nearly half (41.3%) deviated from the ideal weight by more than 10%. Of those halves, 12.4% deviated by more than 20% from the standard. Gender, age, experience, and education of the user did not affect accuracy. The authors suggest that these differences may be clinically significant for medications with narrow therapeutic windows. McDevitt JT, Gurst AH, Chen Y. Accuracy of tablet splitting. **Pharmacotherapy 1998;18:193-7.**

Changes in Metered Dose Inhalers

As chlorofluorocarbon (CFC) propellants are replaced in metered dose inhalers, new products will become available for all of the standard inhaled medications. Patients (and parents) may have questions about why their standard inhalers have changed and what impact this will have on their therapy. This article from the National Asthma Education and Prevention Program is designed for distribution to patients and careproviders. The article is written in a question and answer format, addressing both the safety and effectiveness of newer non-CFC inhalers. It is written in lay language, although it may be difficult for those reading at less than 10th grade level. The article also provides a number of resources for additional information, with both phone numbers and Internet addresses. National Asthma Education and Prevention Program. Your metered-dose inhaler will be changing: Here are the facts. **Am J Health-Syst Pharm 1998;55:276-8.**

Cytochrome P-450 Drug Interactions

This extensive review provides an updated summation of drug interactions mediated through the hepatic cytochrome P-450 enzyme system. The author focuses on those interactions known to result in clinically significant alterations in serum drug concentrations. A comprehensive table is included which lists the interactions, methods for patients management, and suggestions for alternative medications. Michalets EL. Update: Clinically significant cytochrome P-450 drug interactions. **Pharmacotherapy 1998;18:84-112.**

Furosemide: Bolus versus Infusion

The efficacy of conventional intermittent bolus dosing of furosemide was compared to a 6-hour infusion in 30 premature infants following red cell transfusion. Infants were randomized to receive either a single 1 mg/kg dose of furosemide followed by a saline (placebo) infusion or a small loading dose of 0.1 mg/kg furosemide followed by an infusion of 0.9 mg/kg given over a period of 6 hours, providing the same total dose. Mean airway pressure, percentage inspired oxygen, urine output, blood pressure, fractional excretion of sodium, serum sodium, creatinine, and calcium were not found to be significantly different between the groups throughout the 24 hour observation period. The authors concluded that continuous infusions of furosemide do not appear to offer any advantage over conventional dose administration methods. Reiter PD, Makhlouf R, Stiles AD. Comparison of a 6-hour infusion versus bolus furosemide in premature infants. **Pharmacotherapy 1998;18:63-8.**

Future Drug Expenditures

This article, a project of the American Society of Health-System Pharmacists Center on Pharmacy Practice Management, describes trends in drug costs over the past year and projections for the current year. Evaluation of multiple databases revealed an approximate increase in drug costs of 1-3% during the first six months of 1997. Prescription drugs made up the greatest part of the increase, with costs rising approximately 2.7%. Analysts predict a continued rise for 1998 of approximately 2-4%. This trend may remain true for the next several years, as an escalating number of new pharmaceutical products are released onto the market. Several tables of investigational agents nearing FDA approval which will significantly impact drug budgets are also included. Mehl B, Santell JP. Projecting future drug expenditures-1998. **Am J Health-Syst Pharm 1998;55:127-36.**

Preservatives in Nebulizer Solutions

This review addresses the continued practice of adding preservatives to medications formulated for nebulization. The article focuses on the two most frequently used preservatives in the United States: benzalkonium chloride and EDTA. Both in vitro and in vivo data are presented to highlight potential toxicities. The authors make a convincing case for their recommendation that manufacturers be required to market their products in preservative free unit-dose formulations. Beasley R, Fishwick D, Miles JF, et al. Preservatives in nebulizer solutions: Risks without benefits. **Pharmacotherapy 1998;18:130-9.**

Formulary Update

The following actions were taken by the Pharmacy and Therapeutics Committee at their meeting on 2/27/98:

1. Raloxifene (Evista®; Lilly) was added to the formulary as a third line agent for the prevention of osteoporosis in postmenopausal women who have contraindications or are unable to tolerate estrogen or alendronate.

Several new antiretrovirals were also added to the formulary upon recommendation of the Antimicrobial Subcommittee:

2. Delavirdine (Rescriptor®; Pharmacia & Upjohn) was added for the treatment of patients with HIV infection. This agent is designed to be used in combination with other antiviral drugs.

3. Saquinavir soft gel capsules (Fortovase®; Roche) were also added for the treatment of patients with HIV infection. This new formulation will gradually replace Invirase®.

4. The combination of zidovudine and lamivudine (Combivir®; Glaxo-Wellcome) was also added to the formulary for HIV patients. Although combination products are typically discouraged, this product significantly decreases the total number of capsules these patients must take each day.

Contributing Editor: Marcia L. Buck, PharmD
Editorial Board: Anne E. Hendrick, PharmD
Michelle W. McCarthy, PharmD
If you have any comments or would like to be on our mailing list, please contact Marcia Buck by mail at Box 274-11, University of Virginia Medical Center, Charlottesville, VA 22908 or by phone (804) 982-0921, fax (804) 982-1682, or e-mail to mlb3u@virginia.edu.