CLINICAL REPORT Guidance for the Clinician in Rendering Pediatric Care

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Drugs Used to Treat Pediatric Emergencies

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This clinical report is a revision of "Preparing for Pediatric Emergencies: Drugs to Consider." It updates the list, indications, and dosages of medications used to treat pediatric emergencies in the prehospital, pediatric clinic, and emergency department settings. Although it is not an all-inclusive list of medications that may be used in all emergencies, this resource will be helpful when treating a vast majority of pediatric medical emergencies. Dosage recommendations are consistent with current emergency references such as the *Advanced Pediatric Life Support* and *Pediatric Advanced Life Support* textbooks and American Heart Association resuscitation guidelines.

INTRODUCTION

Most children present for emergency medical care in physicians' offices, the prehospital setting, or the emergency department (ED). Roughly 28 million (27%) of the annual ED visits in the United States are by children younger than 19 years.[1] Approximately 7% of these children reach the hospital via emergency medical services (EMS).[1] EMS agencies provide the majority of out-of-hospital emergency care to children. Of the 4800 general and short-stay hospitals with 24-hour EDs in the United States during 2006, the majority (87%) admitted children, but only 10% were children's hospitals or had PICUs. A majority (84%) of hospitals would send pediatric patients requiring intensive care to another hospital.[2] Approximately 30% of emergency pediatric visits occurred in children's hospitals.[2] Medical emergencies may occur between once or more per week and once or more per month in pediatricians' offices.[3,4] Given the scope of pediatric emergency care in the United States and to facilitate consistency in the pharmacotherapy of medical emergencies in children, it is incumbent that all health providers who manage critically ill or injured children be knowledgeable of the medications used to treat pediatric emergencies. Changes in the pattern and scope of practice, changes in the dosages and indications of medications, availability of newer drugs, and the discontinuation of older pharmacotherapeutic agents make it necessary to stay updated.

abstract

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Drs Shenoi and Timm prepared, reviewed, revised, and approved the final manuscript, including the drug tables and references; and all authors approved the final manuscript as submitted.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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This document will be helpful to medical practitioners in the clinic, prehospital setting, and ED. The Supplemental Information contains several tables, each listing medications used to treat pediatric emergencies on the basis of organ system or context (eg, drugs used in disasters). The indications, dosing, and practical points regarding drug administration are described. Description of medication adverse effects is limited. Some drugs may be listed in multiple places because of overlapping indications. Antimicrobial agents (except for in disaster situations), vaccines, and chemotherapeutic agents are not included. The practitioner is referred to the American Academy of Pediatrics (AAP) *Red Book: Report of the Committee on Infectious Diseases* for the treatment of infections.[5] In addition, some drugs that are used to treat pediatric emergencies in consultation with an appropriate medical subspecialist (eg, tissue plasminogen for stroke, intravenous [IV] methylprednisolone for transverse myelitis) are not listed. Dosages are generally provided as milligrams per kilogram. The format for presented dosages is consistent with AAP recommendations for reducing medication errors.[6] Some high-potency drugs, such as prostaglandins, vasopressors, nitroprusside, and fentanyl, have their dosages provided in μg per kilogram. The reader is referred to resources for the safe prescription, administration, and monitoring of medications in their patients.[6]

The IV route is preferred for the administration of medications in an emergency. However, when prompt IV access is not possible, emergency intraosseous administration is an acceptable alternative. The practitioner is advised to consult the pharmacist on the appropriate infusion system whenever possible. Certain drugs (lidocaine, epinephrine, atropine, naloxone [memory aid: LEAN]) can be administered by the endotracheal tube (ET) if no vascular access can be obtained. However, intratracheal drug administration results in lower, less predictable drug concentrations than intravascular administration and is not preferred. If the ET route is used, the drug should be administered with or diluted in 1 to 5 mL of isotonic saline solution followed by manual ventilations. ET administration of naloxone is not recommended for neonates. Newer methods of drug administration in children include the intranasal and intrabuccal routes. These are especially useful in sedation, analgesia, and seizure control. When administering drugs by the intranasal route, it is preferable to use a mucosal atomizer to mist the drug rather than a syringe to drip the medication into the nostrils.

To date, the Best Pharmaceuticals for Children Act and the Pediatric Research Equity Act have resulted in expanded labeling with pediatric-specific information for more than700 drugs.[7] However, gaps in pediatric labeling and dosing information still exist.[8] The reader is encouraged to consult package inserts, drug labels, and medical literature for more information. In some situations, pediatricians may need to prescribe certain medications "off label" for important illnesses. A drug's off-label status does not imply an improper or experimental use. The decision to prescribe these medications off label should be based on expert opinion or evidence for the medication's use in a different population. The reader is referred to the AAP policy statement "Off-Label Use of Drugs in Children"[9] and the US Food and Drug Administration (FDA) for changes in pediatric labeling of drugs.[7]

The information in this document is based on literature review and consensus opinion. References for individual drug indications and dosing are provided. Dosing should be individualized, taking into account the patient's weight in kilograms, medical illness, age, concurrently administered drugs, and drug hypersensitivity history. Within each table, the drugs are listed alphabetically and not by importance of use. The selection of a particular drug may depend on practice variability and drug availability (ie, hospital formulary or drug shortages).

The committees recommend the use of current *Advanced Pediatric Life Support*[10] and *Pediatric Advanced Life Support*[11] textbooks, updated American Heart Association guidelines,[12–14] and additional references for more detailed information on pediatric resuscitation algorithms, rapid-sequence intubation (RSI), procedural sedation,[15] and medical management in disasters.[16,17] In addition, the reader is referred to published treatment guidelines[18]; clinical reports, technical reports, and policy statements[19–31]; and consensus opinion.[32] Practitioners should consult the *Textbook of Neonatal Resuscitation* and updated American Heart Association guidelines for detailed information concerning the management of neonatal emergencies and appropriate drugs, dosages, and routes of administration.[33] The Neonatal Resuscitation Program is focused on care of the newly born infant, and there is no clear evidence to guide when it is appropriate to use *Advanced Pediatric Life Support* guidelines in the care of an infant. General recommendations are currently to decide which drug to use on the basis of the likely etiology of the problem. The use of preprinted weight-based medication cards and/or length-based resuscitation tapes[34] is recommended when treating an emergency regardless of location (prehospital, ED, hospital ward, outpatient, or community clinic).

Note that doses listed are not comprehensive, and variations in dosing may be indicated for specific patients and/or clinical situations.

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ABBREVIATIONS

AAP: American Academy of Pediatrics
ED: emergency department
EMS: emergency medical services
ET: endotracheal tube
FDA: Food and Drug Administration
IV: intravenous
RSI: rapid-sequence intubation

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Drugs Used to Treat Pediatric Emergencies

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