Case Studies in PEDIATRIC EMERGENCY MEDICINE

Anthony J. Haftel

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Preface

The practice of emergency medicine is demanding. Emergency department physicians are constantly being called on to evaluate sick patients and initiate therapy in an expedient, effective manner, frequently with a minimum of information. The spectrum of clinical diseases is as varied as are the patients themselves. The physician may be simultaneously handling an acute myocardial infarction in an elderly man, an ectopic pregnancy in an adolescent heroin abuser, and a febrile seizure in an infant. The successful emergency department physician is well organized, usually has mastered a systematic approach, and has learned to use all available resources (e.g., staff, laboratory, radiology, therapists) efficiently. Time is of the essence, so preplanning and anticipation are key elements of success.

The pediatric patient poses a most definite challenge to the emergency department physician. Most of these physicians do not have very much formal pediatric training and may often be intimidated by the small package that presents itself for repair. Verbal interactions if possible between the pediatric patient and the physician are generally unproductive of historical information, and thus the parent, or guardian, is the main source of the clinical history. Often the parent was not present at the onset of the disease or trauma, so this becomes second hand information, at best. Similarly, the examination of infants and small children is difficult for the practicing emergency department physician who has not mastered the ''tricks'' that most pediatricians use to secure confidence and cooperation in their patients.

The cases presented in this text include a wealth of basic pediatric medicine. Many common emergencies of childhood are covered, such as trauma, infectious disease, endocrine and metabolic disorders, and child abuse. The relevant available history is cited along with the initial results of the physical examination, so

that the reader can develop a differential diagnosis. Cases are juxtaposed, however, to illustrate similar presentations that really manifest different disease processes.

The reader is encouraged to respond to the case presentations by thinking out, or actually writing down, a prioritized list of interventions before looking at the subsequent material.

The section entitled "Suggested Interventions" describes the method suggested by the authors for the management of each particular case. There are few absolutes in medicine, and these suggested interventions should not be construed as the only way to manage any given case but rather as the method of management that would be used in the Emergency Division of Childrens Hospital of Los Angeles.

A comprehensive review of the case is given under the heading "Case Discussion," noting pathophysiology, differential diagnosis, diagnosis, and essentials of therapy. The pharmacologic aspects of the therapy are emphasized. This case discussion serves to highlight the common pitfalls made by "adult-oriented" emergency department physicians who may not see infants and children frequently enough. These areas are stressed as often as possible.

The last section, "Suggested Readings," offers recent literature articles covering the clinical material reviewed in the case presented. Only a few articles are presented for each case discussed. This is intentional and indicates to the already busy practitioner that which is believed to be most relevant and comprehensive.

This type of format should be very useful to the career emergency department physician in approaching the management of difficult pediatric emergencies. It should likewise be useful to the pediatrician who is called on to treat emergencies in a hospital or clinic setting, in that the prioritization of interventions brings to the pediatrician the essence of current emergency practice.

Abbreviations

ABD—abdomen
ABG—arterial blood gas
BP—blood pressure
BUN—blood urea nitrogen
CBC—complete blood cell count
CNS—central nervous system
CPR—cardiopulmonary resuscitation
CSF—cerebrospinal fluid
CT—computed tomography
CVS—cardiovascular
DPT—diphtheria-pertussis-tetanus
ECG—electrocardiogram
EEG—electroencephalogram
ENT—ears, nose, and throat
EOM—extraocular muscle
ESR—erythrocyte sedimentation rate
EXT—extremities
GI—gastrointestinal
GU—genitourinary
HC—head circumference
hCG—human chorionic gonadotropin
HCO_3^-—bicarbonate
HEENT—head, eyes, ears, nose, and throat
HT—height
ICU—intensive care unit
IM—intramuscular
IV—intravenous
IVFD—intravenous, fast drip
IVp—intravenous, push
IVSD—intravenous, slow drip
KVO—keep vein open
NCAT—normocephalic and atraumatic
NEURO—neurologic
NG—nasogastric
NPO—nothing per os
OFC—occipital-frontal circumference
OPV—oral polio vaccine
P—pulse
PEEP—positive end-expiratory pressure
PERRLA—pupils equal, round, react to light and accommodation
PO—per os
RBC—red blood cell
RR—respiratory rate
S_1—first heart sound
S_2—second heart sound

SC—subcutaneous
SGOT—serum glutamic oxaloacetic transaminase
SGPT—serum glutamic pyruvic transminase
T—temperature
VDRL—Venereal Disease Research Laboratory test
WBC—white blood cell
WT—weight

Contents

Case 1

Five-day-old Male with Jaundice

CASE PRESENTATION

A 5-day-old Asian male presented to the emergency department with a chief complaint of jaundice. He was the 3.4-kg product of a full-term pregnancy, born to a gravida 2/para 1 mother by normal spontaneous vaginal delivery. The pregnancy was uncomplicated. The mother received full prenatal care from an obstetrician. Specifically, there was no history of fever, infection, or viral syndromes. The mother reports taking Bendectin®* early in the pregnancy and occasionally acetaminophen (Tylenol®), but she denies taking any other medication. The neonatal history was unremarkable, and the child was discharged home with the mother on the third day of life. The mother's puerperal course was unremarkable. She has lost the child's birth records from the hospital but recalls that "his numbers were good" and notes that he had a ruddy complexion. She can recall no laboratory tests being done.

The infant is breast-feeding 10 to 15 minutes per side every 2 to 3 hours. The mother, concerned that she "doesn't have enough milk," supplements with water every 4 to 6 hours. Over the past 24 hours she reports the child has fed less vigorously and notes only one stool today, whereas the child had been defecating after each feeding previously. Today, the grandmother saw the child for the first time and was concerned that he had jaundice. The family had not yet decided on a pediatrician, and, at the grandmother's urging, have come to the emergency department.

The child is not, by history, irritable, and has not been febrile. There has been no tachypnea, vomiting, or loose or bloody stools. The urine is light yellow, and

*Combined product with doxylamine succinate and pyridoxine hydrochloride.

the mother believes the child voids often. He is taking no medication. There is no family history of liver problems or hematologic problems, except for an uncle with leukemia. There is no family history of diabetes mellitus. The previous child, a male, has no medical problems and was never jaundiced.

A call to the hospital of birth reveals that the "computer is down" and no old laboratory results will be available for 4 or 5 hours.

Vital Signs

T: 36°C (96.8°F; axillary, variable)
P: 140 beats/min
RR: 28/min
BP: 70 mm Hg (palpable)
WT: 3.4 kg

Physical Examination

GEN:	Active and alert, but obviously jaundiced neonate
HEENT:	*Head:* NCAT, no cephalohematoma; anterior fontanelle, 3 × 4 cm, soft; posterior fontanelle, 1 × 2 cm, soft. *Eyes:* icteric sclera; PERRL; red reflex bilaterally. *Ears:* normal pinnae; tympanic membranes poorly seen. *Nose:* no nasal flaring or rhinorrhea. *Throat:* clear
NECK:	Supple; no adenopathy; no anomalies; mongolian spot seen
CHEST:	Clear without retractions
CVS:	Normal without murmur
ABD:	Soft; active bowel sounds; liver down 1 cm below right costal margin; spleen tip felt; kidneys not palpable
GU:	Normal male
NEURO:	Sucks from bottle vigorously; normal complete Moro reflex; moves all extremities symmetrically, not "jittery"
SKIN:	Jaundiced without rash; extremities pink with good capillary refill

SUGGESTED INTERVENTIONS

1. Obtain blood specimens for the following studies:
   a. Bilirubin total and direct fraction, stat
   b. Hemoglobin, hematocrit,* WBC count and differential, and smear for RBC morphology

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**Note:* This is to be a venous or arterial sample since capillary specimens could yield a falsely elevated hematocrit at 5 days of age.

c. Direct Coombs' test,* ABO type and Rh factor
d. One drop on a Dextrostix® (result was 80 mg/dL)
2. Obtain mother's blood for ABO type and Rh, indirect.
3. Send mother and infant to waiting room pending test results. Allow mother to breast-feed the infant if she wishes.

CASE DISCUSSION

Hyperbilirubinemia in the neonate has traditionally been a diagnosis exclusively considered by the pediatrician and family practitioner. With the increasing use of alternate birthing centers and home delivery, combined with ever earlier discharges from maternity wards, the chances of encountering such a patient in an emergency department is likely.

This patient's serum bilirubin value was 17.8 mg/dL with a direct fraction of 2.2. The blood type was O+, as was the mother's. The hematocrit was 66%. RBC morphology was unremarkable without evidence of hemolysis.

Admission for this patient is mandated on the basis of both the hyperbilirubinemia and the polycythemia. At this point an IV infusion of 10% dextrose in 0.5 normal saline at 100 mL/kg/day should be started and the parent encouraged to continue enteral feedings. Any remaining umbilical stump should be cleaned and moistened in the event umbilical catheterization should be necessary.

Admission to a facility where umbilical catheterization and exchange transfusion can be accomplished is necessitated by the increased hematocrit. If necessary, transfer to such a facility should be arranged. The decision to employ exchange or partial-exchange transfusion should be made by a neonatologist or pediatrician who is well versed in similar problems. The emergency department physician's task in this case is to determine the need for admission, or follow-up, and to order any associated tests that serve to clarify such decision making.

Hyperbilirubinemia in an infant in the first month of life is defined as a total serum bilirubin level of 2 mg/dL or greater. Values less than 2 mg/dL can be termed *physiologic jaundice* due to reduced hepatic function compared with that of an adult. The direct-reacting (or conjugated) bilirubin fraction should not exceed 30% of the total.

The danger associated with unconjugated hyperbilirubinemia in the neonate is that of kernicterus, a staining of the basal ganglia with a lipid-soluble bilirubin. This disorder is associated with hypertonicity, developmental delay, seizures, and, occasionally, death. Kernicterus was largely characterized in the 1950s by

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*Records from hospital of birth ruling out isoimmune-mediated hemolytic disease can be substituted.

studying very ill infants with hemolytic disease of the newborn secondary to Rh factor disease. This group has declined substantially in number in recent years; considerable dispute exists in the literature as to the incidence of kernicterus. One can say with certainty that ill, premature neonates are most susceptible to kernicterus, even with bilirubin concentrations of less than 10 mg/dL. The "magic number" of 20 mg/dL has long been held as the indication for exchange transfusion for jaundice. Although incidence of kernicterus in well-appearing, term neonates (such as might present in an emergency department) is debatable, this currently remains the standard of care in most institutions.

The major causes of indirect hyperbilirubinemia can be divided into five groups: (1) increased production or extravascular location of RBCs; (2) increased rate of RBC destruction; (3) reduced conjugation or uptake of bilirubin; (4) decreased excretion of conjugated bilirubin in the bile; and (5) increased reabsorption of unconjugated bilirubin from the GI tract. A complete review of the pathophysiology of neonatal hyperbilirubinemia is not within the scope of this article, nor is it requisite knowledge for the emergency department physician who seeks to identify the infant who needs, or is likely to need, intervention. Certain laboratory tests and their significance in the workup of neonatal hyperbilirubinemia are listed below:

Total bilirubin:	Total for a given age mandates admission for observation or treatment.
Direct bilirubin:	Greater than 30% of total indicates elevation of conjugated bilirubin. Infant should be examined for any signs or symptoms of sepsis (see Case 4). Associated hepatomegaly should be indication for admission to rule out hepatic dysfunction or anomaly.
Hemoglobin/ hematocrit:	Anemia should be considered in any neonate with a hematocrit of 57% or less at 1 day of age; of 46% or less at 1 week of age; and of 31% or less at 1 month of age. Anemia should suggest acute hemolysis or breakdown of extravasated blood (e.g., cephalohematoma) in a jaundiced infant. Polycythemia is a well-recognized cause of jaundice in the neonate. Polycythemia is defined as a hematocrit of 65% or more in a 1-day old, or of 55% or more at 1 week of life. Polycythemia in the newborn should suggest dehydration or "overtransfusion" from late cord clamping or low positioning of the infant before cord clamping.

Maternal and infant blood type, Rh factor: These identify ABO or Rh factor "set-up" children more likely to develop hemolytic disease.

Coombs' test: A direct test on the infant identifies antibodies coating the child's RBCs; an indirect test on the mother identifies circulating antibodies in her serum.

RBC morphology: This test is used to provide direct evidence of hemolysis. In the event of negative ABO or Rh factor workup, the physician should search for other cause (e.g., glucose-6-phosphate dehydrogenase deficiency, spherocytosis, hemoglobinopathy) by history.

Dextrostix®: Certain etiologies of hyperbilirubinemia are associated with hypoglycemia; this is a rapid and inexpensive test, the results of which can be immediately put to therapeutic use.

Criteria for admission based on hematocrit are any value greater than 70%; any value greater than 65% with bilirubin more than 2 mg/dL, irritability, hypoglycemia, poor feeding, and "jitteriness." Criteria for admission based on the bilirubin value are shown below:

Wt (kg)	Bilirubin (mg/dL)	Age (hr)			Remarks
		24 to 48	49 to 72	>72	
	<5	Follow	Follow	Follow	Patients with values less than 5 mg/dL need follow-up, not necessarily a repeat bilirubin test.
	5–9	Follow	Follow	Follow	Patients with values more than 20 mg/dL all need admission.
<2.5	10–14	Admit	Admit*	Admit*	*These patients are
>2.5		Admit	Admit,* if evidence of hemolysis	Admit,* if evidence of hemolysis	less likely to require exchange and may be admitted to a general
<2.5	15–19	Admit	Admit	Admit	pediatric ward; all
>2.5		Admit	Admit*	Admit*	others should go to a center where exchange transfusion is feasible.

Infants with bilirubin values in intermediate ("follow") levels need to be followed at least every 24 hours to ensure the bilirubin value is not approaching a

level that would require exchange. Phototherapy, therapy with light of 402 to 470 nm that converts bilirubin to a photoisomer that is cleared by the liver without conjugation, is used in an inpatient setting on patients whose bilirubin levels and age indicate they may need exchange in the near future. It is not an outpatient therapy, nor is it a substitute for exchange.

The issue of breast-feeding and its relation to jaundice is a very controversial topic. True "breast-milk jaundice" is probably related to pregnane-3α,20β-diol, which inhibits conjugation and is secreted in the breast milk. This jaundice usually arises on the 4th to the 17th day of life; it can be rather high (>20 mg/dL) and may be persistent. Since only 2% of lactating mothers produce this hormone, it is not a common cause of hyperbilirubinemia. We do not advise mothers to discontinue breast-feeding except as a provocative test for this entity. In general, infants discharged home with instructions to return for a check of serum bilirubin levels should continue to breast-feed if the mother so desires.

Any child with direct bilirubin in excess of 30% of the total bilirubin, regardless of total amount, should be admitted for the evaluation of infantile cholestasis.

SUGGESTED READINGS

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