Clinical Problems in Pediatrics

Miller & Mattioli

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PEDIATRICS

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PREFACE

THIS VOLUME of clinical pediatric problems has two purposes. It is intended for those who wish to test their clinical knowledge and judgment concerning common and important clinical problems. At the same time, it presents an opportunity to learn by providing appropriate responses in the Feedback to each problem. It is expected that persons who have had some clinical experience with infants and children and also some familiarity with standard pediatric texts will benefit most from this syllabus. Each pediatric problem is introduced with a brief history or statement of symptoms. Readers are given additional information as they proceed stepwise through diagnosis and treatment. Questions are posed concerning the patient's diagnosis and treatment and readers are asked to determine the appropriate response(s) to the questions asked. These responses are provided separately at the end of each problem under the heading Feedback. Reasons are given as to why certain responses are correct or incorrect, as the case may be.

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HOW TO USE THIS BOOK

Read the brief history or statement of symptoms in the introduction to each problem. Select the correct answer(s) to question A and verify your choice(s) in section A of the Feedback (located at the end of each problem) before going on to question B. It is strongly recommended that you use a shield (slider) to cover the questions and sections of the Feedback you have not yet read.

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III. Young Children, 2–5 Years

IV. Children Six Years and Older

SECTION I

NEWBORN, FIRST MONTH

I–1. RESPIRATORY DISTRESS

You are called to the special care nursery to examine a premature male infant whose mother had arrived at the hospital only 20 minutes before delivery. The mother is a 20-year-old primapara who had no complications during pregnancy. She was 32 weeks pregnant by dates. The delivery was unremarkable. Apgar scores were 7 and 7 at 1 and 5 minutes respectively. Your examination reveals a premature infant weighing 1.4 kg who is having moderate respiratory distress. The nurse has already placed him in 40% oxygen because he was cyanotic in room air. Respiratory rate is 90 per minute; heart rate, 150 per minute. There are moderate retractions and grunting respirations. On auscultation, there is poor aeration over all lung fields; heart sounds are normal and no murmurs are heard. The patient is pink in 40% oxygen, but skin perfusion is poor.

A. Which of the following would you elect to do?
   1. Chest radiograph
   2. Arterial blood gases and pH
   3. Electrocardiogram (ECG)
   4. Blood, urine and nose and throat cultures
   5. Blood glucose determination

B. Your preliminary diagnoses include which of the following?
   1. Respiratory distress syndrome (RDS)
   2. Aspiration pneumonia
   3. Metabolic acidosis
   4. Cyanotic congenital heart disease (CCHD)
   5. Sepsis
   6. Hypoglycemia

C. Your initial therapy includes which of the following?
   1. Ambient oxygen to maintain arterial oxygen tension (Po_2) between 50 and 70 mm Hg
   2. Correct acidosis.
   3. Place infant in Isolette.
   4. Intravenous push of 10% glucose in water
   5. Place infant on continuous positive airway pressure (CPAP).
   6. Continue arterial blood gas monitoring.
   7. Cover with broad spectrum of antibiotics.

D. Over the next 12 hours the patient requires increasing concentra-

tions of oxygen and is developing short apneic episodes. How might you proceed at this point?

1. Reexamine the patient.
2. Obtain chest radiograph.
3. Obtain hematocrit.
4. Obtain blood glucose level.
5. Determine pH, P_{O_2} and P_{CO_2} on arterial blood.

E. Which of the following two complications may be present?

1. Bronchopulmonary dysplasia
2. Cerebral hemorrhage

F. Therapy based on these possible complications should include which of the following?

1. Adrenocorticosteroids
2. Ventilatory support

Feedback

Respiratory difficulty is a common and significant problem in the newborn. The signs of distress include tachypnea (>60 breaths per minute), cyanosis, retractions, grunting and nasal flaring. This patient is having obvious respiratory difficulty, and proper diagnosis and therapy are extremely important.

A. 1. Correct. Chest x-ray reveals no pneumothorax, and a bilateral air bronchogram shows a ground-glass appearance of lungs. The heart is normal in size.

2. Correct. Arterial gases (breathing 40% O_2): pH, 7.20; P_{CO_2}, 40 mm Hg; P_{O_2}, 61 mm Hg. These results represent a metabolic acidosis, normal CO_2 and an adequate P_{O_2}. Although the P_{O_2} is adequate, it is obviously far below expected levels, considering that the baby is breathing 40% O_2.

3. In view of chest x-ray findings, it is not likely that the ECG would be abnormal and it was not. It showed regular sinus rhythm; rate, 160; QRS axis, + 140 and right ventricular hypertrophy, normal for a newborn.

4. Cultures were obtained and sent to the laboratory. In some patients, it is difficult to differentiate between RDS and early onset of sepsis and pneumonia except by cultures.

5. Correct. Blood glucose level was 45 mg/dl. Hypoglycemia is an unlikely cause of infant's signs and symptoms. However, this is

an important consideration in any premature infant and especially one with respiratory distress. The blood glucose of 45 mg/dl is within normal limits for a newborn. The lower limit of normal glucose levels is considered to be 40 mg/dl by some and 30 mg/dl by others.

B. 1. Respiratory distress syndrome is the most likely diagnosis with the constellation of prematurity, respiratory distress and a classical chest x-ray suggesting hyaline membrane disease. This disease affects approximately 25,000 infants each year and is associated with a deficiency of pulmonary surfactant (a phospholipid) that decreases surface tension forces in the alveoli. Without surfactant there are significant areas of atelectasis and proper lung expansion is not possible. This results in respiratory distress and blood gas abnormalities.

2. Aspiration pneumonia is unlikely without a history of fetal distress. In aspiration pneumonia, a patchy, rather than a diffuse, homogeneous process is seen on the chest x-ray. A ground-glass appearance of the lungs on x-ray sometimes is associated with pneumonia.

3. Metabolic acidosis. A blood pH<7.35 represents acidemia. Since arterial P_{CO_2} is normal (40 mm Hg), the pH of 7.20 represents a metabolic, rather than a respiratory, acidosis.

4. Cyanotic congenital heart disease. Possible but unlikely. The poor aeration and abnormal x-ray film indicate a respiratory rather than cardiac basis for distress and cyanosis. The normal ECG and normal cardiac silhouette help to rule out most causes of cyanotic heart disease. Sometimes the differential diagnosis between CCHD and RDS is difficult to make except by echocardiography or by cardiac catheterization.

5. Sepsis. In the newborn period, this diagnosis should be considered on the basis of "soft" symptoms and signs in the baby, such as lethargy, disinterest in food, poor suck, low body temperature, generalized hypotonia, increased irritability, failure to gain weight. At present, evidence of sepsis is lacking and a presumptive diagnosis of RDS is indicated.

6. Hypoglycemia: Glucose level is normal.

C. 1. Ambient oxygen to maintain an arterial P_{O_2} between 50 and 70 mm Hg is appropriate in RDS. Arterial oxygen must be adequate to supply the metabolic needs of the infant. Excessive oxygen may result in retrolental fibroplasia and permanently impaired vision, which are more likely to occur when P_{O_2} ex-

ceeds 100 mm Hg. The lungs are also susceptible to bronchopulmonary dysplasia when exposed to high oxygen levels for a prolonged period.

2. Correct acidosis. This patient has a significant acidosis that requires correction to normal levels of pH to promote normal metabolism and to prevent the side effects of acidemia (e.g., pulmonary artery vasoconstriction, norepinephrine release and shift of oxygen dissociation curve to right).
3. Place in incubator. This allows for proper temperature and humidity control, reverse isolation and constant observation of the infant.
4. Intravenous push of 10% glucose in water is not necessary with normal glucose levels, provided baby can take oral feedings without difficulty. Many babies who have RDS will not be able to take oral feedings well during its acute phase. Intravenous routes other than the umbilical vein should be used for administering fluids if possible. The umbilicus is frequently infected; blood cultures taken from the umbilical vein are more likely to be positive than cultures from other venous sites.
5. Continuous positive airway pressure. Application of an end-expiratory distending pressure in RDS has been shown to be an effective means of increasing arterial P_{O_2}. At present, this patient does not meet the criteria for CPAP, since $P_{O_2} = 61$ mm Hg in 40% oxygen.
6. Monitoring blood gas is needed to control the administration of oxygen, prevent its retinal and pulmonary complications and follow the course of the disease. RDS may increase in severity in the first few days. Placing a catheter in the umbilical artery allows blood to be drawn easily and quickly, as frequently as thought necessary. Replacement of blood by transfusion with adult whole blood or packed red cells will be needed, depending on amount drawn from umbilical artery.
7. Approve. Your patient may have early onset of Group B streptococcal pneumonia.

D. 1. Correct. Reexamine the patient. Anterior fontanel is soft. Auscultation of chest reveals poor aeration of lungs. Heart sounds loudest at the lower left sternal border. A grade II/VI machinery murmur is heard under left clavicle, suggesting patent ductus.

2. Correct. Chest x-ray reveals complete opacification of the lungs with no pneumothorax; heart size is normal.

3. Correct. Hematocrit, 53%. (No change since admission.)
4. Correct. Blood glucose, 48 mg/dl.
5. Correct. Arterial blood studies: pH, 7.27; P_{O_2} in 70% oxygen, 42 mm Hg; P_{CO_2}, 51 mm Hg. These results indicate decreasing ventilation and oxygenation, as evidenced by low P_{O_2} and increase in P_{CO_2}.

E. 1. Unlikely. Bronchopulmonary dysplasia is usually recognized 3–6 weeks after birth.
2. Unlikely. Cerebral hemorrhage is a frequent complication in RDS of small premature infants, but is not likely with a soft fontanel and unchanging hematocrit.

F. 1. Adrenocorticosteroids have not been found helpful in postnatal treatment of RDS or in prevention of retrolental fibroplasia or of bronchopulmonary dysplasia.
2. Support ventilation. This patient now meets the criteria for ventilatory support (low arterial P_{O_2} in 70% oxygen and apnea). The choice between CPAP or placing the patient on a respirator varies among neonatologists.

I–2. JAUNDICE

A white male infant weighing 3,200 gm at birth is jaundiced on the second day after birth. He was given 1 mg of menadione (Hykinone) intramuscularly at birth. He is 50 cm long and has a head circumference of 34 cm. His temperature is 36.8 C. His skin is yellow. The liver is 2 cm below the costal margin in the midclavicular line and the tip of the spleen is palpable. The mother's blood type is O−. She has two living children. She received Rh_0 (D) immune gamma globulin (human) (RhoGAM) following the birth of her last baby. Her Rh antibody titer during this pregnancy remained at 1:4. Cord blood: total bilirubin was 3.5 mg/dl; hematocrit, 51%; direct Coombs' test was weakly positive; blood type, A+.

A. Which of the following laboratory tests do you order?
   1. Complete blood count (CBC)
   2. Serum bilirubin level
   3. Reticulocyte count
   4. Blood culture
   5. Anti-A antibodies in cord blood
   6. Fragility test on red blood cells
   7. Glucose 6-phosphate dehydrogenase on blood

B. You conclude from the results of the laboratory tests available to you that he may have which of the following?
   1. Hemolytic disease related to AO incompatibility
   2. Hereditary spherocytosis
   3. Excessive internal hemorrhage
   4. Sepsis
   5. Cytomegalic inclusion disease

C. As a result of these tests you decide to:
   1. Perform an exchange transfusion.
   2. Start antibiotic therapy.
   3. Discontinue breast feeding.
   4. Start phototherapy.
   5. Follow levels of bilirubin and hemoglobin in blood.

Feedback

A. 1. CBC results: hemoglobin, 13 gm/dl; hematocrit, 51%; white blood cells (WBC), 15,000/cu mm; polymorphs, 69%; monocytes, 15%; lymphocytes, 10%; eosinophils, 6%; platelets,

150,000/cu mm. Numerous nucleated red cells, many spherocytes and polychromasia were present in blood smear.
2. Total serum bilirubin, 13 mg/dl; indirect bilirubin, 12 mg/dl; direct bilirubin, 1 mg/dl.
3. Reticulocyte count, 12%.
4. Approve blood culture.
5. Anti-A antibodies in cord blood, 1:200.
6. Fragility of red cells increased because of large numbers of spherocytes.
7. Glucose 6-phosphate dehydrogenase, normal.

B. 1. Laboratory findings and clinical course are compatible with hemolytic disease caused by AO incompatibility.
2. Family history is negative for hereditary spherocytosis. Positive Coombs' test and 1:200 titer of anti-A antibodies are not expected in hereditary spherocytosis.
3. High reticulocyte count is expected following excessive hemorrhage, but patient shows no clinical evidence of hemorrhage and has normal platelet count and received synthetic vitamin K at birth.
4. Not likely in view of positive Coombs' test and high titer of anti-A antibodies. However, he could have sepsis in addition to AO incompatibility. Blood culture was negative at end of 48 hours. He has no soft or hard signs of sepsis.
5. Cytomegalic inclusion disease not likely as primary diagnosis. However, even healthy-appearing newborn infants may shed cytomegalic viruses.

C. 1. No indication for exchange transfusion.
2. Approve. If blood culture is negative at end of 48 hours, you can probably discontinue antibiotics safely.
3. Disapprove. Usually hyperbilirubinemia that is produced by inhibition of glucuronyl transferase by pregnane-3 α 20 β-diol in breast milk appears between 4 and 7 days after birth.
4. Approve phototherapy.
5. Approve. Frequent determinations of serum bilirubin and blood hemoglobin should be made. His bilirubin did not rise above 15 mg/dl and gradually fell to 8 mg/dl on the sixth day after birth. His hemoglobin fell to 11 gm/dl. You discharged him on day 6 and plan to see him 2 days later for repeat determination of bilirubin.