

Neonatal Respiratory Distress in the Community Hospital: When to Transport, When to Keep

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Neonatal respiratory distress is a common problem confronting family physicians. Although respiratory distress may represent a benign, self-limited process, it may also be the first sign of sepsis or serious cardiopulmonary disease. Because it is crucial to differentiate the two, we offer a practical approach to the treatment of neonatal respiratory distress at community hospitals.

Our method, the Rule of 2 Hours, is based on readily

accessible clinical findings. We believe it will help physicians detect babies at risk for serious problems, but will not result in unnecessary referral of neonates that are simply adapting to extrauterine life.

KEY WORDS. Infant, newborn; respiratory distress syndrome; neonatal screening; patient transfer; physicians, family. (*J Fam Pract* 1998; 46:284-289)

Neonatal respiratory distress often becomes apparent shortly after birth and is a common problem for family physicians in rural community hospitals. Respiratory distress can be due to a benign process, such as delayed adaptation or transient tachypnea (wet lung) of the newborn, but it can also be the first and only manifestation of serious infection. It is crucial to differentiate the two.

In Iowa, nearly one half of all babies are born in small community hospitals that have fewer than 500 births annually.¹ Newborn care in these hospitals is usually provided by physicians who may not routinely care for sick newborns. Thus, when confronted with neonatal respiratory distress, the rural family physician must decide whether neonatal transport is required.

We performed a MEDLINE search of articles published between 1966 and the present but did not find any articles addressing the initial evaluation of neonatal respiratory distress in the rural setting. Therefore, we were motivated to provide a practical approach for family physicians faced with this common problem.

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BACKGROUND

Since 1973, Iowa has maintained a program that assists community hospitals in providing quality perinatal care as close to the patient's home as possible. On a cyclical basis, the staff of this program, known as the Iowa Statewide Perinatal Care Program, visit every Iowa hospital with a maternity unit. During these visits, members of a perinatal team (an obstetrician, pediatrician, obstetric nurse, and neonatal nurse) gather data about the perinatal experiences of the hospital. Following this review, an educational program is presented to the hospital staff. The authors are current members of the perinatal team (H.H. and M.L.) and the Advisory Committee for the Perinatal Program (J.E.).

The knowledge gained in the nearly 25 years of experience with this perinatal program has indicated that respiratory distress is unquestionably the most common reason that sick neonates require transfer to a referral center. We found that 79% of all transports involved a baby with respiratory distress. Thus, it is important for family physicians to know how to evaluate and manage this common problem.

We have developed a set of clinical guidelines to help decide whether to transport or observe a baby with respiratory distress. In this article, we provide an overview of respiratory distress in the newborn and offer a practical management approach for family physicians working in small community hospitals.

RELATIONSHIP BETWEEN SEPSIS AND RESPIRATORY DISTRESS

Sepsis neonatorum is the term used to describe any systemic bacterial infection in the first 28 days of life.² Although new and potent antimicrobial agents are available, bacterial infections are still a common cause of neonatal morbidity and mortality. The incidence of neonatal sepsis varies from fewer than one to 8.1 cases per 1000 live births,³ and in the pre-antibiotic era it was almost always fatal. Now, with the appropriate use of antibiotics, the morbidity and mortality of sepsis has been significantly reduced. It is important to recognize the early signs of sepsis so that antibiotics can be started as soon as possible. Unfortunately, sepsis does not always present with clear-cut signs.⁴

Perhaps the earliest indication of infection in the newborn occurs in the uterus when the fetus shows signs of distress.^{3,5} When this is the case, the newborn frequently shows signs of sepsis at birth, or soon after, that may manifest in low Apgar scores. Such observations, although helpful, may indicate a number of clinical situations other than infection. In the final analysis, sepsis is suspected on the basis of clinical signs in the newborn, including: respiratory distress, poor feeding, diminished responsiveness, apnea, lethargy, fever or hypothermia, jaundice, vomiting, diarrhea, hepatosplenomegaly, and even skin problems such as petechiae or microabscesses.^{3,6}

The earliest and most common signs of sepsis may vary depending on the population surveyed. Our experience corroborates the observation that respiratory distress is a common presenting sign of infection in the newborn.^{3,7,8} Respiratory distress from benign causes, however, cannot be clearly differentiated from infection during the first few hours of life. If bacterial infection is the cause of respiratory distress and antibiotics are not given, the infection may rapidly progress to septic shock and death.

NEONATAL RESPIRATORY DISTRESS

The physician's question seems simple at first: "What is the appropriate management of neonatal respiratory distress in the first hours of life?" However, our experience has revealed several potential pitfalls. First, respiratory distress must be diagnosed by health care providers, and this can be accomplished

only when they can recognize abnormalities. We have read numerous notes in babies' charts that state, "The respiratory rate is [anything >60], but there are no signs of respiratory distress." However, a respiratory rate of more than 60 is, by definition, respiratory distress.^{9,10} The presenting signs of respiratory distress include: tachypnea (respiratory rate >60/minute), subcostal and intercostal retractions, nasal flaring, grunting, tugging, and cyanosis.¹¹ Any or all of these signs constitute neonatal respiratory distress.

Next, the physician must consider the potential causes of respiratory distress and the difficulties in attempting to make a definitive diagnosis in the first hours of life. Some causes are relatively innocent, but others are potentially life-threatening. A major mistake is to make the diagnosis of a benign condition and assume that the newborn is going to improve. For example, the local radiologist may read the chest radiograph as "consistent with transient tachypnea of the newborn." This diagnosis, however, can be made only in retrospect. In general, radiographs taken in the first 24 hours of life are extremely difficult to read, even by pediatric radiologists. This is because the appearance of pneumonia, wet lung, and even hyaline membrane disease can be difficult to distinguish.^{12,13} A baby may also have respiratory distress from more than one cause, such as transient tachypnea and pneumonia.

It would be nearly impossible to make a precise diagnosis in the rural community hospital under most circumstances. It is important only to recognize whether the problem is consistent with normal, transitional processes (adaptation to extrauterine life) or whether the problem demands more attention.

NEONATAL TRANSITION

Transition, also known as neonatal adaptation, refers to the adjustment of the newborn from intrauterine existence to extrauterine life. The detection of neonatal illnesses soon after delivery requires a knowledge of the normal features of the transitional stage.

After delivery, the neonate's heart rate increases for approximately 10 to 15 minutes. Heart rates of 160 to 180 beats per minute are not unusual compared with the normal baseline fetal rate of 120 to 140 beats per minute. Also, during this period, the neonate's respirations may be irregular, and respira-

TABLE

Causes of Neonatal Respiratory Distress in the First 2 Hours of Life in Term or Near-Term Infants

Pulmonary	Nonpulmonary
Pneumothorax	Congestive heart failure
Transient tachypnea of the newborn	Persistent fetal circulation
Meconium aspiration	Polycythemia
Pneumonia	Hypoglycemia
Congenital malformations	Central nervous system
Pulmonary hemorrhage (rare)	Neuromuscular disorders
Upper airway obstruction	Anemia
Problems of transition	Other infections (not necessarily pneumonia)

nonspecific and consistent with neonatal sepsis or pneumonia, most infants with TTN are evaluated for infection and are treated with broad-spectrum antibiotics pending a definitive diagnosis.^{4,8,12,13,15}

The assumption that a baby has TTN on the basis of a radiographic interpretation in the first hours of life may be an error. When TTN is the correct diagnosis, it usually is a benign process. However, an infection in the first day of life can appear similar to the clinical picture of TTN. Transient tachypnea usually resolves in 24 hours, or in

tory rates of 60 to 80 breaths per minute may be observed. In addition, grunting, flaring, and retraction may be seen. During the time when the heart rate is increased and the respiratory rate is increased and irregular, the baby should remain alert, have spontaneous startle responses, have lip movements as if to suckle, have tremors, move his head from side to side, and cry. Soon after this period of reactivity, the infant either sleeps or has a marked decrease in motor activity. Brief periods of tachypnea may be observed again for approximately 1 to 2 hours after birth.¹⁴

It is important to note that the tachypnea during this normal transition period is not unrelenting and progressive. Observation of an infant for the first 2 hours of life should allow health care providers to determine whether the baby is making an acceptable adaptation to extrauterine life.

TRANSIENT TACHYPNEA

Transient tachypnea of the newborn (TTN) presents shortly after birth with grunting, retractions, and tachypnea. Although the precise cause of TTN remains unknown, it is a common belief that infants with TTN have distention of alveolar spaces with fluid, leading to air trapping and decreased lung compliance.

No radiographic findings that indicate this disorder are conclusive, but suggestive findings include increased central vascular markings, hyperaeration, evidence of interstitial and pleural fluid, and occasionally cardiomegaly. Because the signs of TTN are

some cases, 24 to 48 hours. When the baby no longer shows signs of respiratory distress and the x-ray film shows a clear or nearly clear picture, then the diagnosis of TTN is secure. An infectious process, however, will not clear in such a short time.¹⁶ Thus, if the initial radiographic picture that was thought to show TTN actually indicates an infection, the baby may be much worse off because of the delay in starting antibiotic therapy.

DIFFERENTIAL DIAGNOSIS OF RESPIRATORY DISTRESS IN THE NEWBORN

In addition to infection and TTN, there are many other reasons babies may present with respiratory distress. These causes, summarized in the Table, can be separated into pulmonary and nonpulmonary causes. The majority of these causes require management beyond the capabilities of most rural hospitals. Thus, it is not necessary for the family physician to arrive at a precise diagnosis, but rather to recognize that the baby has a problem that is unlikely to be quickly resolved.

EVALUATING THE PROBLEM

Over the past 25 years, the Iowa perinatal team has developed a simple system for evaluating neonates with respiratory distress. Because the system requires making a decision within 2 hours after respiratory distress is evident, it has been referred to as the Rule of 2 Hours. The 2-hour limit is sufficient time to determine if the baby has a mild, self-resolv-

ing problem, and if the respiratory distress is an early manifestation of newborn infection, the decision can be made quickly enough to ensure effective and appropriate use of antibiotics.^{4,12}

When persistent respiratory distress, as defined above, is observed at or shortly after birth, physicians are asked to immediately obtain a chest radiograph, posteroanterior and lateral views, and to transfer the baby if one or more of the following is true:

1. The chest radiograph is not normal as determined by the local physician.
2. The baby requires more than 40% oxygen to be adequately saturated (95% or more by pulse oximetry or, if oximetry is not available, evaluated by infant's color).
3. The baby is worsening.
4. Two hours have passed and the baby is no better.

Chest Film Not Normal. The first recommendation is to transfer the baby if the chest film is not normal, as determined by the local physician. Radiologists may not be present full-time in smaller hospitals. Accordingly, physicians receive supplementary training in interpreting newborn chest radiographs during our hospital visits so that they can make a fundamental differentiation between normal and abnormal. Specifically, they are taught how to detect the presence of infiltrates, pneumothoraces, pleural fluid, and cardiomegaly. Although the nature of infiltrates cannot be readily identified as respiratory distress syndrome, compared with pneumonia or TTN, recognizing the presence of an infiltrate is what matters. Other abnormalities, such as pleural fluid, cardiomegaly, and pneumothoraces, can also be recognized. Physicians are encouraged to share all newborn chest radiographs with their colleagues, preferably with the staff radiologist in attendance. We particularly encourage sharing those films that demonstrate abnormal results.

Baby Requires More than 40% Oxygen to Be Adequately Saturated. The baby should also be transferred if he requires more than 40% oxygen to be adequately saturated (95% or more by pulse oximetry or, if oximetry is not available, evaluated by the infant's color). The level of 40% was chosen to dissuade physicians from gaining a false sense of security by obtaining adequate oxygen saturations with increasing levels of ambient oxygen.¹⁷

Term or near-term babies will readily shunt from right to left if they are not receiving adequate oxygen or have elevated levels of carbon dioxide. Both a low PaO_2 and an elevated $PaCO_2$ are known to increase the infant's pulmonary vascular resistance and lead to shunting.¹⁸

The level of 40% ambient oxygen represents a value sufficiently above the baby's normal requirements but does not approach the maximum achievable level. We are not aware of any clinical studies that would indicate the exact level of ambient oxygen that always indicates trouble for the neonate.

If a term or near-term baby is desaturated as observed clinically or by oximetry, he should be immediately placed in 100% oxygen. If he then saturates to 100%, the level of oxygen can be reduced, but never to a point where saturations fall below 95%. If it is necessary to provide more than a moderate amount of oxygen to keep saturations up, the baby may be having more than simple transitional problems.

The Baby Is Worsening. The third recommendation is to transfer a baby who is worsening. The Rule of 2 Hours should not be mistaken to mean that 2 hours is an absolutely safe period to observe the baby. We suggest that if the baby's condition deteriorates in any fashion (ie, increasing respiratory distress, poor perfusion, increased oxygen requirement, development of fever, or any other sign of illness), the baby's transfer should be effected immediately and the consulting physician queried about the advisability of starting antibiotics before transfer.

Two Hours Have Passed and the Baby Is No Better. Finally, we recommend a transfer if 2 hours have passed and the baby is no better. Here we mean that 2 hours or nearly 2 hours have passed and the baby still shows signs of respiratory distress and does not appear to be improving. A baby going through transition will not persist with respiratory distress for the entire period, and thus the ill neonate and the transitional neonate should not be confused at the end of the 2-hour observation period.

Many times, the decision to transfer can be made as soon as the chest radiograph has been completed. It is also reasonable to obtain a complete blood count to help rule out anemia or infection. We do not believe that a high white blood count or left shift are of much concern in the first 24 hours of life; however, the presence of neu-

tropenia is a sign of potential illness. Over the years, the authors and others¹⁹ have noted that during the first 24 hours of life, neutropenia is frequently associated with bacterial infection. In general, if a baby has fewer than 2000 neutrophils/ μ L, we are concerned. This number is above the usual definition of neutropenia (1500/ μ L), but 2000 neutrophils/ μ L is still considerably below the average normal baby's count.

JOINT MANAGEMENT

The Rule of 2 Hours should provide a sound basis for managing most neonates with respiratory distress. When the decision is unclear, however, the physician who will receive the potential referral should be consulted. This joint management should include discussions about the need for antibiotics before transfer. If the decision is to start antibiotics, the consultant can offer advice about the choice of antibiotics, the doses, and the route(s) of administration. Generally, the combination of ampicillin and gentamicin is still the first choice of most neonatologists in the United States.^{3 (p389)}

The issue of whether blood and cerebrospinal fluid (CSF) should be obtained for culture before the first dose of antibiotics is another decision that will benefit from joint management. The consultant will usually urge obtaining blood and CSF if the baby is stable enough to tolerate the procedure. If the baby is already showing cardiac or respiratory compromise, the consultant will usually suggest giving the antibiotics and not spending excessive amounts of time obtaining cultures.³

In emergencies, antibiotics can be given intramuscularly. However, if the baby is quite ill and not perfusing adequately, his inability to absorb the medication in this manner must be considered. In these circumstances, most consultants would recommend giving the medication intravenously. This is difficult to do for a baby, especially one who is perfusing poorly, so many times the only readily available intravenous route is the umbilical vein.

CANNULATING THE UMBILICAL VEIN

One of the more common mistakes made by physicians who do not routinely do this procedure is to cut the cord too long. When the cord is longer than 1 cm, the vessels may be coiled and hard to cannulate. Accordingly, the cord should be cut short, no longer

than 1 cm. If the physician is concerned about bleeding from the cord, a ligature of umbilical tape can be passed around the base of the cord and tightened if necessary.

Any obvious clot should be removed from the umbilical vein, and then a fluid-filled No. 5 or 8 French catheter should be inserted until a free flow of blood is obtained. (The two small dark dots [clotted blood] represent umbilical arteries; the rather patulous third vessel is the umbilical vein.) The catheter can then be anchored to the abdominal wall with enough tape to prevent movement, and the antibiotics should be infused as indicated. Continuing intravenous fluids may be necessary until the transport team arrives, and the catheter can be left in place.

A useful rule to remember is that approximately 100 cc/kg/24 h will be adequate to maintain the baby over the duration of transport. Either D5W or D10W can be used. D10W is the choice when blood glucose is low.

FURTHER STABILIZATION

Once the decision to transport has been made, staff members may feel that their jobs are done. However, this is the time when the baby may need the most attention. It is important to document vital signs during the interim between transport decision-making and actual transport. It is also important to frequently check the baby's temperature and to keep him or her within a normal range. The glucose level should be checked regularly, and if it falls below 40 mg/dL, treatment with D10W should be initiated. The appropriate initial dose is 2 to 4 cc of D10W, and the route depends on the degree of illness. If the baby is obtunded or seizing, then the intravenous route is recommended either peripherally or through the umbilical vein. Otherwise, gavage feeding is acceptable. It is especially important to continue to check the baby's glucose levels if a hypoglycemic level has been previously documented. Nipple-feeding babies in respiratory distress are at risk for aspiration. Thus, it is better to provide glucose either intravenously or by gavage.

The appropriate use of oxygen in the sick neonate is frequently misunderstood. Because of fears about retrolental fibroplasia in preterm babies, many physicians withhold adequate oxygen from the neonate. With term and near-term neonates, there should be no concern over using

adequate amounts of oxygen. In most cases, if the baby is not saturating to normal levels (above 95%),²⁰ we recommend the use of 100% oxygen. It is far better to apply this through a hood than in an incubator. This method improves both efficiency and economy. When the baby is saturating near 100%, then the oxygen concentrate can be reduced, but we do not recommend reducing it to below 95%. For preterm babies, maintaining saturation in the 90% to 95% range is acceptable.

COMMUNICATING WITH THE PARENTS

Many parents are understandably concerned when they are told that their baby will require a transfer to a neonatal facility. The physician should assure the parents of the competency of the neonatal referral center, and explain to them that the decision to transport is clearly in the best interests of the baby. If the mother is capable of traveling, we urge that both parents go to the referral center as soon as possible. We cannot overemphasize the importance of keeping parents fully informed about the status of their baby and easing their fears as much as possible.

CONCLUSIONS

Our 25 years' experience with the Iowa perinatal program has given us much respect for the importance of recognizing respiratory distress in the immediate neonatal period. No one has studied the outcomes of neonates with respiratory distress who were transferred compared with those not transferred, so we cannot present prospective data about the utility of the Rule of 2 Hours. We believe it would be unethical to do so. However, we have learned anecdotally that the Rule of 2 Hours has been a reasonable management method for ill neonates. During the early years of the perinatal program, it was common for physicians to observe babies overnight to determine if they required more definitive treatment. Overnight is an excessively long period to observe a neonate with respiratory distress. Accordingly, we sought to change the so-called Rule of Overnight to the Rule of 2 Hours. Physicians have regretted not following the Rule of 2 Hours, but we have never heard of a physician who regretted abiding by it. In our experience, the Rule of 2 Hours has provided a commonsense approach to effectively managing respiratory distress, one of the most common problems in the newborn.

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