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Diagnosis and Management of Respiratory Syncytial Virus

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Introduction

For many primary care physicians, the notion of respiratory syncytial virus (RSV) often brings up the mental image of young patients with bronchiolitis, so it is easy to forget that the virus can affect all age groups and cause a wide spectrum of illnesses, from mild upper respiratory illness to respiratory failure. The purpose of this article is to broaden the understanding of RSV, its epidemiology, pathophysiology, diagnosis, and treatment, and to familiarize the reader with evidence-based clinical management guidelines.

History and Epidemiology

RSV was first discovered in chimpanzees and initially named chimpanzee coryza agent.[1] Researchers subsequently realized that the virus originated in humans, so Chanock et al later proposed a name change to respiratory syncytial virus.[2]

RSV is seen worldwide and affects people of all ages. The very young, very old, and immunocompromised are at highest risk for life-threatening infections. Its incidence varies by time of year, occurring mostly in the winter and early spring months in temperate climates. In most of the United States, the peak months are November through March.[3] (*See Figures 1 and 2.*)

Infants and Children

RSV is the most common cause of lower respiratory infection in children younger than 1 year of age. Almost all children become exposed to the virus by age 3. Approximately 2-3% of those infected require hospitalization, of which 2-5% develop respiratory failure and require intubation. In the United States, RSV is associated with between 132,000 and 172,000 hospitalizations annually in children younger than 5 years of age.[4] Globally, RSV is responsible for as many as 34 million episodes of acute lower respiratory tract infections, 3.4

Executive Summary

- RSV occurs primarily in the winter months in the United States and is a cause of significant morbidity and mortality, particularly in the very young and very old.
- While there are rapid tests for RSV, a clinical diagnosis can be made in otherwise well-appearing children.
- RSV is a common cause of viral respiratory disease in adults. Little is known about the best therapy for adults.
- In infants, bronchodilators and steroids are generally not effective.

million hospitalizations, and up to 199,000 deaths per year in children younger than 5 years of age.[5] Groups that are at highest risk are premature infants, those with congenital heart and pulmonary diseases, as well as immunodeficient infants. Boys (more so than girls), children exposed to secondhand smoke, and those living in poverty are also more prone to RSV infection and illness.[6]

Adults

Thompson et al estimated that RSV accounts for approximately 10,000 annual deaths in the United States in people older than the age of 65 years.[7] In a 2005 prospective study, RSV was found to be the cause of respiratory infection in 3-7% of otherwise healthy elderly individuals and 4-10% of those with chronic heart or lung diseases, an incidence double that of influenza.[8] Among hospitalized patients, those diagnosed with RSV had similar mortality (8% vs. 7%), intensive care unit (ICU) admission rate (15% vs. 12%), and use of mechanical ventilation (13% vs. 10%) to influenza A.

Pathophysiology

There are two strains of RSV (A and B), and it is part of the *Paramyxoviridae* family (genus *Pneumovirus*). (*See Figure 3.*) It is an enveloped RNA virus that is nonsegmented, which means it cannot undergo reassortment and change its virulence as easily as viruses such as influenza or rotavirus.[9] The virus creates large sheets of multinucleated cells that are formed by the merging of smaller, neighboring cells through the help of its surface proteins. These "syncytia" have been widely studied in vitro, yet exactly how these syncytia contribute to pathogenesis (or whether they do at all) is uncertain.

Transmission of the virus is mostly thought to be through contact with large droplets that can survive on surfaces for hours.[10] The virus appears to become unstable when aerosolized, so small-particle transmission is not a major mode of infection.[11] The duration of viral shedding appears to be variable and dependent on whether the infection is primary or reinfection, the severity of the infection, and the age of patient. Younger patients with primary infections tend to shed for longer periods of time. In one study, the average shedding duration in infants was 6.7 days, with a range of 1-21 days.[12] In another study, the average shedding time was 3.9 days, with a range of 1-17 days in healthy working adults.[13] It has been shown that the spread of nosocomial RSV infection can be significantly decreased with contact isolation and use of gloves and gowns by providers.[14]

It is thought that the RSV infection pathway starts with a nasopharyngeal inoculation via direct contact with the virus. The virus then makes its way down into the epithelium of the respiratory tract by either cell-to-cell transfer or aspiration. In the lower airways, lymphocytic infiltration and mucus hypersecretion begin, followed by necrosis of the bronchial epithelium. The sloughing of these necrotic cells and its associated edema lead to airway resistance and air trapping.[15] Young infants tend to be more adversely affected by this process, as airway resistance is inversely proportional to the airway radius to the fourth power. In infants with pneumonia, there is also marked inflammation of the lung interstitial tissue and alveoli.

It appears that both humoral and cellular pathways are activated during the infection process. The inflammatory reactions are partly responsible for the development of immunity; however, they are also responsible for the production of byproducts that cause symptoms of bronchiolitis. For instance, it appears that the types of cytokines and chemokines that become activated play a role in the severity of disease.[16,17] Reinfections are possible due to generally incomplete immunity development, although subsequent infections tend to be milder in severity.

RSV Association with Reactive Airway Disease

RSV infection and its relationship to asthma has long been a topic of controversy. Many studies have shown a correlation between the two.[18] In a recent article, 206 children diagnosed with severe RSV bronchiolitis before 1 year of age were prospectively enrolled. These children were followed up to their 7th birthday, and the parents were asked whether asthma was diagnosed by a physician. The study found that 48% of children with severe RSV bronchiolitis were subsequently diagnosed with asthma.[19] This study, however, did not attempt to assess causation.

This topic was addressed in another study, which evaluated 95,310 children in a large cohort study looking at the relationship between birth date in relation to RSV season and the development of asthma. They found that infants born 122 days prior to the winter RSV virus peak had the highest risk

Figure 1: CDC RSV Seasonal Duration by Region

Source: Centers for Disease Control and Prevention.

of developing clinically significant bronchiolitis. In addition, infants who were 121 days old during peak season were at highest risk of developing asthma. Finally, having bronchiolitis at any age was associated with an increased risk of developing asthma. Based on these findings, these researchers made the bold statement that "evidence from our analyses provide compelling support for a causal role of winter viruses in the development of asthma."[20] To support their theory, the authors pointed out that infants have lost most of their maternal antibodies by 4 months of age, and immunoglobulin activity is at its nadir. Furthermore, acute viral infections at this age may lead to chronic airway sequelae, as well as effects on immune regulation and development. Although these are highly plausible explanations from a pathophysiology standpoint, the controversy is far from settled at this point.

Clinical Presentation: Infants and Children

RSV infection appears to cause different symptoms in premature neonates. In a study by Forster et al in the neonatal intensive care unit (NICU) setting, the presenting symptom was bradycardia in 75% of the cases who were tested positive for RSV. Other significant symptoms include cyanosis, body temperature instability, and hypercapnia.[21]

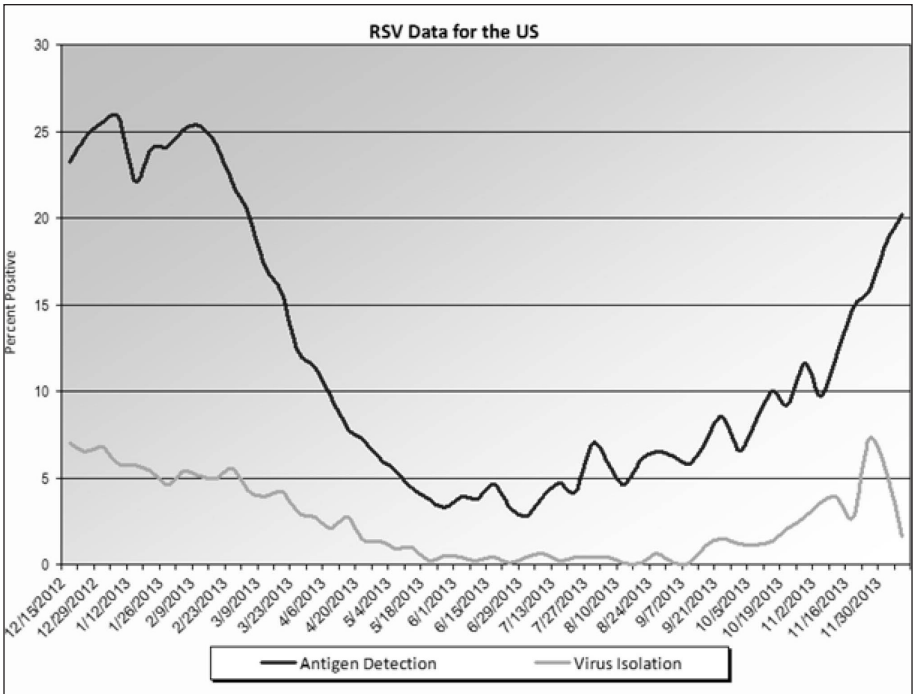
In young infants, RSV has been found to be associated with spells of apnea, with a reported incidence in excess of 20% in some cases.[22] The mechanism of how RSV causes apnea is unclear, although it is generally thought to be centrally mediated. In a retrospective cohort study of 691 hospitalized infants 6 months of age or younger with bronchiolitis, Wilwerth et al identified the following risk factors for apnea:

- Preterm infants (born less than 37 weeks) younger than 48 weeks post conception on presentation;
- Term infants age 1 month or younger on admission;
- Those with a previously witnessed apnea episode by a doctor or parent.[23]

Another case control study by Arms et al found that most infants with apnea were younger than 2 months and were symptomatic for less than 5 days.[24] Finally, a study by Kneyber et al found that age younger than 2 months was the strongest predictor for apnea on admission, and was the strongest predictor for recurrent episodes of apnea in their patient population.[25]

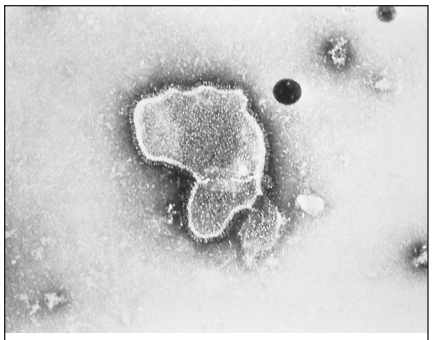
In infants and young children, upper respiratory symptoms are the most common presentation of children with RSV infection. Between 20-30% develop lower respiratory infections such as bronchiolitis and pneumonia, and a smaller percentage develop upper airway diseases such as croup and tracheobronchitis.[26] Severity of disease can vary from mild wheezing to severe respiratory distress and even respiratory failure. Prematurity, in particular, is a significant risk factor for more

Figure 2: CDC Seasonal Variation of Antigen and Viral Positivity



Source: Centers for Disease Control and Prevention

Figure 3: Respiratory Syncytial Virus



Electron microscope image of respiratory syncytial virus. Source: Centers for Disease Control and Prevention

severe disease.[27] In a cohort study by Swingler et al in children with bronchiolitis in the ambulatory setting, the median duration of illness was 12 days; however, 9% were still symptomatic after 28 days.[28] In another study by Petruzella et al, the median duration of bronchiolitis symptomatology was 15 days, with 25% of patients still symptomatic after 21 days.[29] In children with reinfections, the presenting symptoms may be similar to primary infections but are often less intense, of shorter duration, and predominantly involving the upper respiratory tract.

Adults and Elderly

In otherwise healthy adults, RSV infections usually cause a self-limiting upper respiratory infection in which symptoms such are cough and rhinorrhea are dominant. Ear and sinus involvement can also occur, but headache, fever, and gastrointestinal symptoms are less common than with infection with influenza.[13] In the elderly and immunocompromised, RSV can cause lower respiratory infection and pneumonia, and respiratory failure can develop.[30] In a recent retrospective cohort study in which the mean age of patients with RSV was 75 years old, 71.9% of patients were diagnosed with a lower respiratory complication. In addition, 12.5% had bacterial superinfections, and 11.1% required mechanical ventilation. Patients had a mean length of hospital stay of 12 days, and all-cause mortality of 9.1% at 30 days and 11.9% at 60 days.[31] In a study by Widmer et al, hospitalized patients with RSV tended to be older and more immunocompromised when compared to those diagnosed with influenza.[32] Morbidity and mortality from RSV infection can be quite significant in transplant patients. Bone marrow transplant recipients have mortality as high as 60-80%, while their solid organ (e.g., lung, kidney) transplant counterparts tend to be less affected.[33,34]

The duration of symptoms from RSV infection is dependent on whether the infection is a primary infection, the immune status of the patient, and the presence of associated cardiopulmonary diseases. In the previously mentioned study by Falsey et al, the duration of RSV-related illness was approximately 2 weeks in the elderly population. In these patients, there was also a significant associated functional impairment; 39% of the healthy elderly group and 45% of high-risk adults could not perform their regular daily activities for at least 1 day of their illness.[8]

Differential Diagnosis

RSV should be included in the differential diagnosis for any patient presenting with an upper or lower respiratory illness. Patients presenting in peak fall and winter months should be considered at high risk. It should also be considered in patients who are suspected of influenza but who do not test positive for influenza. Other viruses such as influenza, rhinovirus, adenovirus, human metapneumovirus, and parainfluenza can cause similar clinical symptoms.

Diagnostic Approach

The gold standard of RSV diagnosis is the detection of live virus in cell culture. Other means of diagnosis include detection of viral antigen by immunoassays and detection of viral nucleic acids by polymerase chain reaction (PCR). The specimen required is generally a nasopharyngeal aspirate or swab.[15] The antigen tests have the advantages of being

readily available, having a rapid turnaround time, and having sensitivities greater than 90%. The PCR test has a longer turnaround time, but is more sensitive than the antigen tests. Serology is not helpful in children or adults because repeated infections can result in a stable and sustained level of elevated RSV-specific antibody throughout a person's life.

Infants and Children

In children who present with the classic bronchiolitis picture during peak RSV season, a clinical diagnosis may be made without further testing. In children who present out of the usual seasonal distribution and who do not present with classic symptoms, RSV testing may be useful. Other routine laboratory tests are generally of minimal value.

One question that is often raised is when to image patients with suspected RSV infection. To address this issue, Kneyber et al derived a model for predicting a normal chest X-ray based on age, birth weight, presence of rhinitis, presence of retractions, and arterial oxygen saturation.[35] The current recommendation from the American Academy of Pediatrics (AAP) is not to routinely image children clinically diagnosed with bronchiolitis unless they fall into high-risk groups (age younger than 12 weeks, history of prematurity, underlying cardiopulmonary disease, or immunodeficiency). This is partly based on the fact that patients who underwent routine imaging had higher rates of antibiotic use without change in recovery time. However, radiography may be useful when the hospitalized child does not improve at the expected rate, if the severity of disease requires further evaluation, or if another diagnosis is suspected.[36]

Other studies have focused on the predictive value of chest radiography. In a Portuguese multicenter study, neonates with consolidation on chest X-ray and confirmed RSV had worse outcomes in terms of length of NICU stay and mechanical ventilation days.[37] However, in another study, chest X-rays had little predictive value on the clinical severity of disease in hospitalized children on general pediatric floors. The researchers suggested, therefore, that the use of radiography be limited to the intensive care setting.[38]

Another question often asked by physicians is whether febrile young infants diagnosed with RSV should undergo a full septic workup to exclude other sources of serious bacterial infection (SBI). Levine et al conducted a multicenter, prospective study that looked at 1248 infants aged 60 days or younger presenting to the emergency department with a febrile illness. Almost all of these children underwent testing of blood, urine, stool, and cerebrospinal fluid. Two hundred sixty-nine children (22%) in the group were documented to have RSV infection. The rate of SBI in RSV-positive children (7%) was significantly lower compared with RSV-negative children (12.5%). Most cases of SBI in those who were RSV-positive were urinary tract infections, and none had concomitant bacterial meningitis. The rate of bacteremia was 1.1% in the RSV-positive group (all in infants younger than 29 days of age) and 2.3% in the RSV-negative group. On the other hand, the rate of SBI was not significantly different in neonates younger than 29 days who tested positive or negative for RSV.[39] These findings were largely echoed by other similar studies.[40-43] Hence, in well-appearing febrile infants who test positive for RSV, blood and urine testing alone may be adequate to rule out SBI, particularly in those who are older than 29 days old.

Adults

In adults, the diagnostic approach may vary, and there is very little literature on the subject. As in the case of children, clinical diagnosis can be made in those with no risk factors or mild symptoms. However, clinicians should be wary of underlying chronic conditions in many adults and have a lower threshold for imaging and laboratory testing to help narrow down the differential diagnosis. Coinfection with RSV is also possible in patients with community-acquired pneumonia. In a study by Lieberman et al, 7.1% of patients diagnosed with community-acquired pneumonia were also found to be positive for RSV on nasal swab.[44] RSV testing in these cases may help prevent nosocomial spread of the virus, as well as optimize therapy for the individuals affected.

Management and Prevention

The treatment of RSV infection is highly dependent on the presentation and severity of disease. In general, treatment is mainly supportive; however, many adjunctive therapies have been evaluated over the years.

Infants and Children

In young children without serious respiratory distress, many times supplemental oxygen and frequent suctioning of secretion can be sufficiently therapeutic. Mechanical ventilation may be necessary at times for those presenting in respiratory failure.[15] It is also important for clinicians to assess hydration. Very young infants who are breathing at rates greater than 60 breaths per minute may not feed adequately and are very prone to dehydration and aspiration. These infants, therefore, should be admitted for hydration and observation until their respiratory rates allow for safe feeding.[36]

Bronchodilators. Bronchodilators such as albuterol have long been used and studied in RSV bronchiolitis. Unfortunately, there is no clear consensus as to their effectiveness. It may be easier to understand why wheezing in RSV bronchiolitis may not respond to bronchodilators by returning to the pathophysiology of the disease. In reactive airway disease such as asthma, the wheezing is a symptom related to bronchoconstriction and air trapping. As beta and alpha agonists work to dilate the airway smooth muscles, there is usually significant improvement in symptomatology. In viral bronchiolitis, the sloughing of cells and their collection in small airways, along with the excess secretions, are the reasons for air trapping, so bronchodilators

Table 1: Summary of Treatment Options for RSV

Infants/Children	Adults
Bronchodilators (albuterol, racemic epinephrine) • Equivocal effectiveness • May trial and continue if positive response	Bronchodilators (albuterol, racemic epinephrine) • Equivocal effectiveness • May trial and continue if positive response
Hypertonic (3%) saline • Shortened inpatient length of stay • No proven benefit in ED patients	Hypertonic (3%) saline • No data
Corticosteroids • No more effective than placebo • Not recommended	Corticosteroids • No more effective than placebo • Not recommended
Antiviral (ribavirin) • Trend of benefit in small inpatient studies • Not recommended in routine use • Consider in severe/high-risk cases	Antiviral (ribavirin) • May be useful in stem cell transplant patients • Consider in other severe/high-risk cases
Palivizumab • Ineffective as a treatment • Prophylactic use in specific at-risk patients	Palivizumab • May be useful in stem cell transplant patients when combined with ribavirin

have limited effect. In addition, it has been shown that these aerosolized medications have poor penetration into the bronchioles of infected infants due to the thick secretions.[46]

In a large Cochrane review, 28 randomized, controlled trials were analyzed to compare bronchodilators (excluding epinephrine) to placebo in infants with bronchiolitis. In this review, it was concluded that bronchodilators did not improve oxygen saturation, reduce hospital admission rate, reduce hospital length of stay, or reduce time to resolution of illness.[45] Similar meta-analyses specific to RSV infections have concluded that bronchodilators are not efficacious in the treatment of RSV bronchiolitis. Nevertheless, several studies on intubated patients showed improvement of pulmonary function studies performed using ventilators after bronchodilator treatment.[46]

In a study by Skjerven et al, nebulized racemic adrenaline was compared with inhaled saline in hospitalized infants younger than 12 months of age diagnosed with moderate-to-severe bronchiolitis. In this multicenter, randomized, double-blind trial, 404 patients were evaluated for length of stay, use of oxygen, need for tube feeding, need for ventilatory support, and relative improvement in the clinical score from baseline. There did not appear to be a statistically significant difference between those who had received nebulized adrenaline and saline in any of these measures.[47] These findings echo an earlier randomized, controlled study by Wainwright et al, in which there did not appear to be a statistically significant difference in length of hospital stay, need for supplemental oxygen or intravenous fluids, or respiratory effort scores between young infants who received nebulized racemic epinephrine and saline in the inpatient setting.[48]

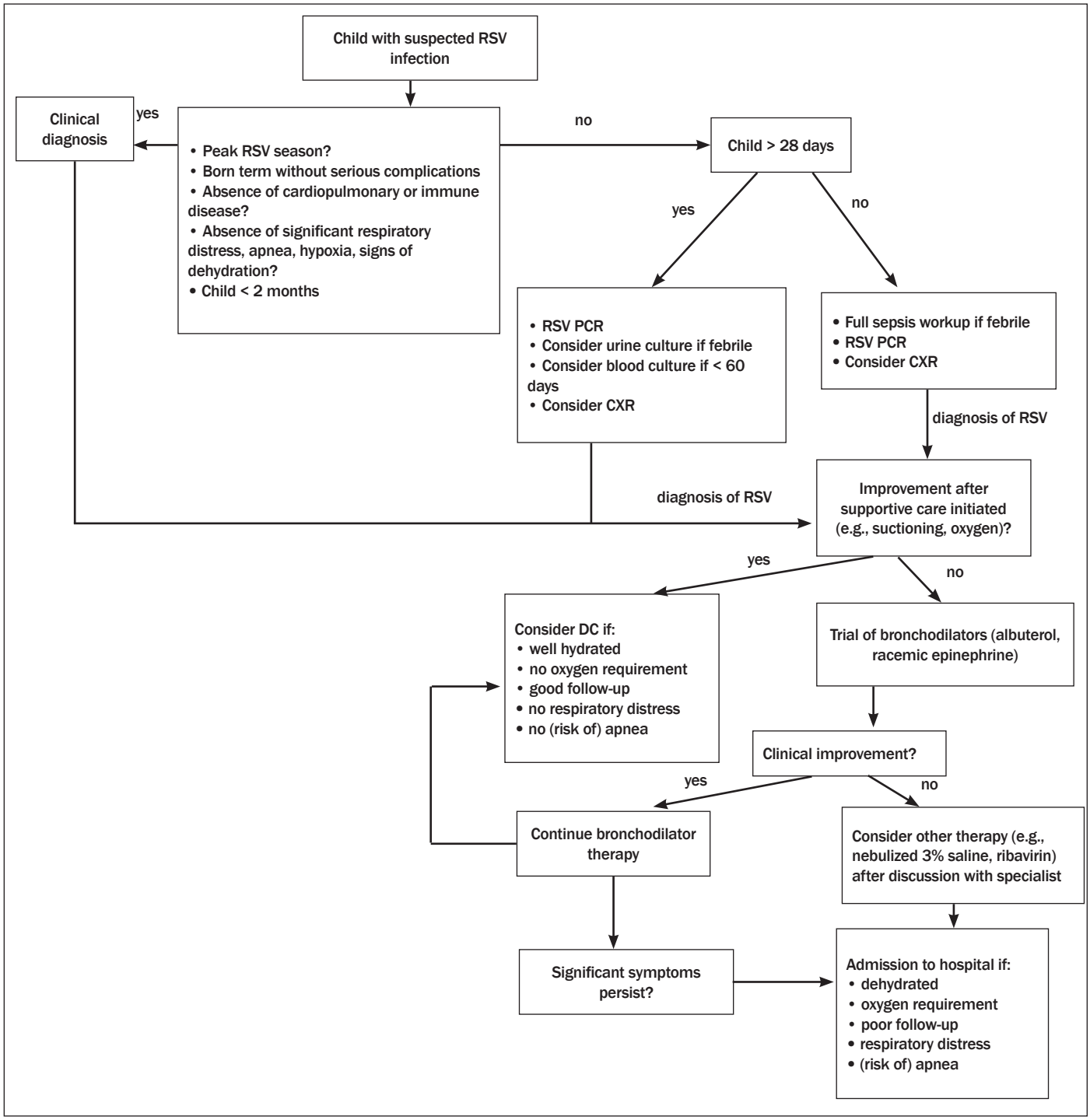
Although the AAP guideline states that bronchodilators should not be used routinely in the management of bronchiolitis, many clinicians are still using these medications in their practice. This is likely based on the notion that viral bronchiolitis cannot be fully distinguished from reactive airway disease in young children, so a trial of the (relatively harmless) bronchodilators is appropriate. This practice is also acknowledged in the AAP guidelines, which state that "a carefully monitored trial of alpha-adrenergic or beta-adrenergic medication is an option. Inhaled bronchodilators should be continued only if there is a documented positive clinical response to the trial using an objective means of evaluation."[36]

Hypertonic Saline. Nebulized 3% saline solution has also been studied as a treatment for RSV bronchiolitis. In a meta-analysis by Zhang et al, 11 trials enrolling more than 1000 patients who had mild to moderate bronchiolitis were included. Nebulized 3% saline was compared with nebulized 0.9% saline. They found that hospitalized children in the hypertonic saline group had a shorter average length of hospital stay than those in the 0.9% saline group. However, treatment with nebulized 3% saline did not result in any significant outcome benefit in emergency department (ED) patients. The authors concluded that although there may be a role for nebulized hypertonic saline in the inpatient setting, its acute use in the ED appeared to be limited from the current studies.[49]

Steroids. In a Cochrane review, there was no statistically significant benefit on hospital stay or clinical outcomes with the use of corticosteroids when compared with placebo.[50] This is also reflected in the AAP guidelines, which advise against the use of both enteral and inhaled corticosteroids in acute viral bronchiolitis.[36]

Antiviral. Aerosolized ribavirin has been studied as a treatment for RSV. The majority of the research has been done on young children in hospitalized settings. Although some studies have shown that ribavirin shortens hospitalization time, reduces duration of mechanical ventilation, and improves clinical scores, all were limited by small sample size, low power, and wide confidence intervals.[51-54] Furthermore, these benefits have not been consistently demonstrated in other studies. For

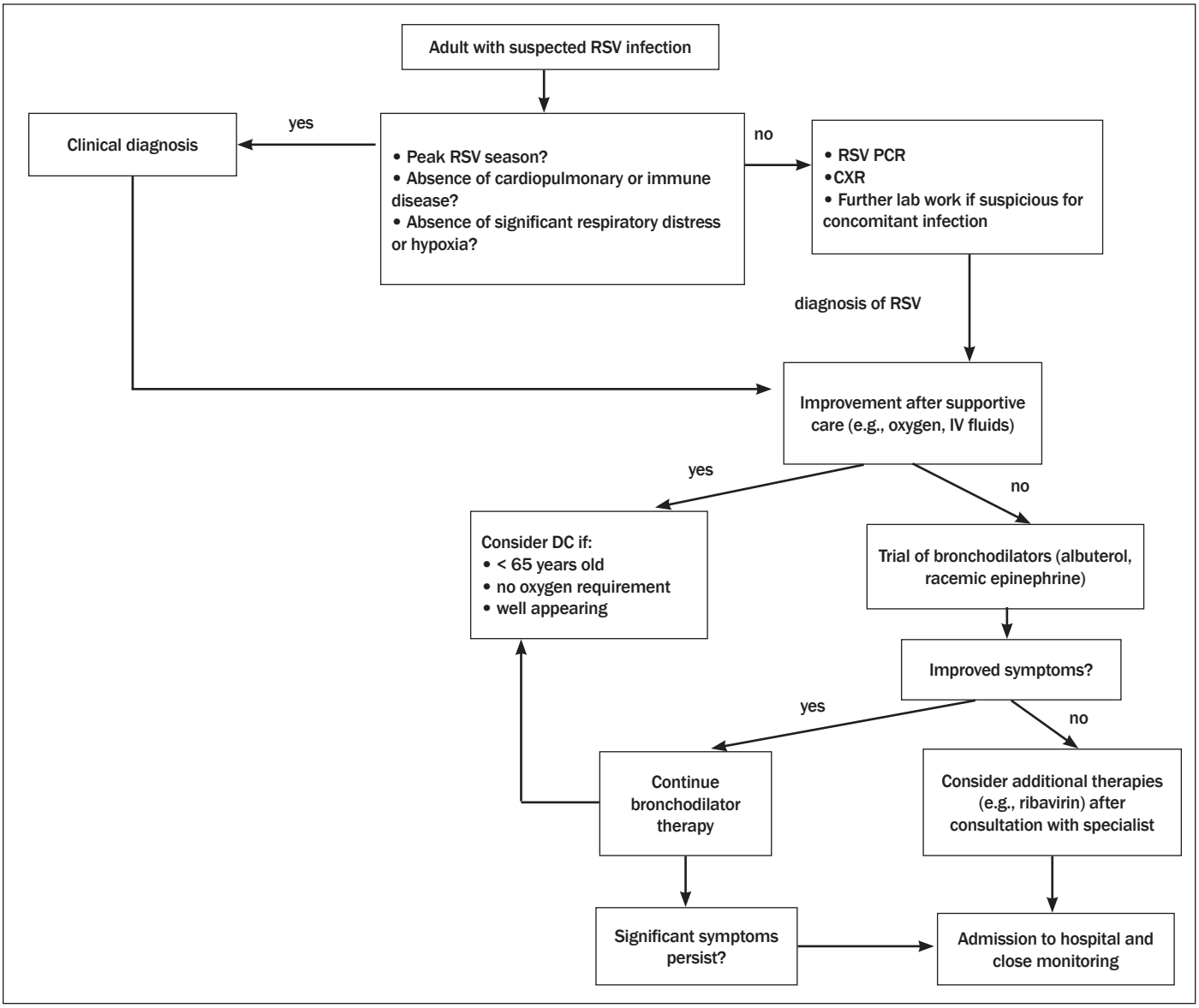
Figure 4: RSV Evaluation: Children



example, in a prospective, randomized study by Everard et al, there was no significant difference between the ribavirin and placebo groups in the length of hospital stay or clinical improvement at 24 hours.[55] Another small prospective, randomized study by Guerguerian et al attempted to look at the benefits of ribavirin on mechanically ventilated children without other significant comorbidities, and found no significant difference between the aerosolized ribavirin and aerosolized saline groups.[56]

Other studies have attempted to determine the effects of ribavirin on the recurrence of disease. One study focused on the incidence of recurrent episodes of reactive airway disease and hospitalizations after early treatment with ribavirin during initial RSV infection. This study found that ribavirin-treated children had fewer and less severe reactive airway disease and recurrent respiratory infections than those in the control group. Although it was a prospective study, there were only 49 subjects.[57] In another small prospective study,

Figure 5: RSV Evaluation: Adults



children given ribavirin tended to have fewer wheezing episodes and reactive airway complaints on long-term follow-up.[58]

Due to the lack of convincing evidence for the use of ribavirin, the AAP advises against its routine use in the general population. AAP does acknowledge, however, that its use may be considered in individuals with severe disease, or those who are at risk for severe disease (e.g, immunocompromised and/or hemodynamically significant cardiopulmonary disease).[36]

Vaccination. Due to the lack of effective therapy for RSV infections, many have focused on possible preventative efforts. In the 1960s, a vaccine was developed and tested in children, but the trials were stopped due to its adverse outcomes. The findings from these early trials showed that not only was the vaccine not protective against severe RSV infection, but many vaccinated children had an augmented reaction to initial RSV exposure and presented with more severe disease. Nearly 80% of the children vaccinated were hospitalized for respiratory infections when compared to 5% of the control subjects. Two infants who received the vaccine also died from subsequent RSV infection. Although the exact mechanisms of the paradoxical response is not fully understood, studies have suggested that the activation of cellular and humoral immunity was altered, and that the proliferation of lymphocytes was exaggerated in those who were vaccinated.[59]

In recent years, there have been renewed efforts at RSV vaccine development. Several vaccines utilizing various mechanisms have been created, but so far none has been proven effective in clinical human trials.[60]

Antibody. Palivizumab is a humanized mouse monoclonal antibody that can be given at the beginning of the RSV season for a total

of five doses approximately 1 month apart. The antibody is very costly and is not recommended for the general population. It is recommended for use in children with chronic lung disease, premature infants, and children with hemodynamically significant congenital heart disease, and is likely beneficial in children with immune deficiencies.[61,36] In two randomized, controlled trials, it was found that patients at high risk who were pretreated with palivizumab had significantly lower hospitalization rates than the control groups.[62] The cost is approximately $288/kg body weight, with a recommended dose of 15 mg/kg. Due to its significant cost, it is uncertain whether this is cost effective in all patients for whom it may be recommended.[63]

Adults

Bronchodilators. Although extensive research has gone into studying the effect of bronchodilators in young infants and children, very limited studies or recommendations are available for adult patients with RSV infection. Because adults with RSV lower respiratory infections often have coinfections and multiple comorbidities, it is much harder to develop a guideline that applies to such a heterogeneous population. Therefore, a reasonable approach would be a bronchodilator trial in all patients, which should be discontinued if no substantial improvement is shown. Alpha- or beta-adrenergic medication should be used with caution in patients with coexisting cardiac disease. In all cases, the potential risks should be considered and weighed against the possible benefits.

Antiviral. When it comes to the use of ribavirin, even less research is available on its efficacy and safety in adults when compared to that available regarding children. Nevertheless, studies on the use of ribavirin in both aerosolized and oral forms have been published. One recent randomized, controlled study was conducted on hematopoietic cell transplant recipients. It showed decreased viral loads in patients pretreated with ribavirin.[64] In a retrospective study on adults with hematologic malignancies and recipients of stem cell transplants, it was suggested that a risk factor for developing RSV pneumonia was failure to use RSV-directed antiviral therapy.[65] These benefits have not been as well studied in those with solid organ transplants, and the efficacy of ribavirin is unknown in such patients.[66,67] Although it is currently approved by the FDA for use in children, ribavirin is not FDA approved for use in adults. It is also important to remember the safety issues surrounding its use. Aerosolized ribavirin has been shown to have teratogenic effects in animal studies, so pregnant female health care workers should avoid administering it. In addition, aerosolized ribavirin has been associated with bronchospasm, so it may need to be administered with prophylactic bronchodilators.[68]

Antibody. In adults, the use of palivizumab has been studied in combination with ribavirin in hematopoietic stem cell transplant patients. In a small study, prophylactic palivizumab was given to high-risk patients in a ward where an RSV outbreak was occurring. Of the 16 RSV-negative patients who received the antibody, none developed active disease.[69] More extensive research is necessary to determine to the cost/benefit issues surrounding use of this medication.

Disposition

Disposition of patients diagnosed with RSV should be made based on their clinical status, degree of respiratory distress, hydration status, and presence of risk factors or comorbidities. Admission for supportive care should be considered for those at risk for decompensation and respiratory failure. The enclosed algorithms provide a guideline for the workup and disposition of such patients. (*See Figures 4 and 5.*)

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Primary Care Reports CME Objectives

Upon completion of this activity, participants should be able to:

1. Summarize recent, significant studies related to the practice of primary care medicine;
2. Evaluate the credibility of published data and recommendations related to primary care medicine;
3. Discuss the advantages and disadvantages of new diagnostic and therapeutic procedures in the primary care setting.

CME Questions

1. What are the peak months of RSV season in most of the continental United States?
   a. November through March
   b. February through June
   c. May through September
   d. All year long
2. How is RSV thought to be transmitted?
   a. Aerosolized particles
   b. large droplets
   c. Food borne
   d. Blood borne
3. The majority of patients infected with RSV have which of the following symptoms?
   a. Lower respiratory tract symptoms
   b. Upper respiratory tract symptoms
   c. Apnea or hypercapnia
   d. Headache and fever
4. Which of the following is true regarding chest X-ray studies in children with RSV?
   a. Chest X-rays should be performed routinely in all children diagnosed with RSV.
   b. Chest X-rays have good predictive value on the severity of clinical disease.
   c. Chest X-rays can help decrease antibiotic use.
   d. Chest X-rays are not recommended in children without risk factors.
5. Which of the following is true of the relationship between RSV infection and asthma?
   a. RSV infection is a proven cause of asthma.
   b. RSV infection decreases the likelihood of future asthma.
   c. RSV infection is correlated with development of future asthma.
   d. There is no relationship between RSV infection and asthma.
6. According to the current literature, what is the most appropriate workup for a 30-day-old infant who presents with fever and a positive RSV antigen screen?
   a. Blood culture, urine culture, chest X-ray, cerebrospinal fluid (CSF) culture
   b. Blood culture, urine culture, CSF culture
   c. Blood culture, urine culture
   d. Blood culture only
7. How does RSV compare with influenza in terms of mortality and morbidity among hospitalized patients?
   a. Both have similar mortality rates and intensive care unit (ICU) admission rates.
   b. Influenza has a higher mortality and a higher ICU admission rate.
   c. RSV has a higher mortality rate but a lower ICU admission rate.
   d. RSV has a lower mortality rate but a higher ICU admission rate.
8. Which of the following is true regarding albuterol as a treatment for RSV bronchiolitis?
   a. Albuterol has not been proven effective as a treatment.
   b. Albuterol improves oxygen saturation.
   c. Albuterol reduces time to resolution of illness.
   d. Albuterol decreases hospital length of stay.

In Future Issues: Updates in psychiatry for the primary care physician

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