

TREATMENT APPROACHES IN RESPIRATORY TRACT INFECTIONS IN PAEDIATRICS: A REVIEW

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ABSTRACT

Any infectious condition of the upper or lower respiratory tract is referred to as a respiratory tract infection (RTI). Both industrialised and developing nations experience extremely high rates of respiratory tract infections in children. Preventive strategies should be taken precedence because accurate diagnosis and effective treatments for these recurring respiratory tract infections have significant limitations. So, it is crucial for the health care provider to recognize any RTI that could have more severe consequences for the kid and necessitate medical attention. Diagnosis can be usually made from the prior medical history and presenting symptoms such as cough, wheezing, feeding problems, tachypnea, fever, or stridor and appropriate therapy is offered. Studying treatment methods for paediatric respiratory tract infections is the goal of this review.

KEY WORDS; Respiratory Tract Infections, Paediatrics, Upper Respiratory Tract Infections, Lower Respiratory Tract Infections, Immunostimulants.

INTRODUCTION

The respiratory system starts from the nasal cavities, followed by the trachea or wind-pipe, the bronchi and bronchioles (collectively called ‘airways’) ending in the alveoli of the lungs. Viral and bacterial infections can affect any part of this system, and they are called as Respiratory Tract Infections (RTI).⁽⁵⁾ These are further divided into:

Upper respiratory tract infections (URTI): These occur in the nose and throat, pharynx etc.

Lower respiratory tract infections (LRTI): These occur in the trachea, windpipe and lungs etc.⁽⁵⁾

Some common viruses that cause RTI include; Influenza virus, Adenovirus, Rhinovirus, Respiratory syncytial virus (RSV) etc.

Some common bacteria that cause RTI include; S.pneumoniae, H.influenzae, Mycoplasma pneumonia etc.
(4,5)

Reasons for increased vulnerability in children with respiratory tract infections are;

- Shorter respiratory tract as compared with that of adults, which leads to faster spread of infection.
- Absence of breast feeding.
- Increased rate of exposure to respiratory pathogens from older siblings and other children while attending daycare facilities; however, this helps to build up immunity against pathogens in the long term.
- Exposure to passive smoking and other environmental pollutants dust, pollen.
- Acquired immunity has not developed in young infants.
- Defects in the immune system.
- Familial predisposition.

Pathophysiology

URTI: The pathogens gain direct entry into the respiratory tract by inhalation of droplets and invade to the mucosal layer, which leads to epithelial destruction, along with redness, edema, hemorrhage and sometimes an exudate.

LRTI: The pathogens enter the distal airway by inhalation, aspiration or by hematogenous spread. The pathogens divides and multiplies in the epithelium, causing inflammation, increased mucus secretion, and impaired mucociliary function; other lung functions may also be affected. ^(4,7)

Clinical manifestations in children

- Fever and cough (but neonates may have unstable temperatures, with hypothermia)
- Tachypnoea with a respiratory rate higher than 60 (age <6 months), 50 (age 6-12 months) or 40 (age >12 months) breaths per minute.
- Crackles in the chest.
- Nasal flaring.
- Chest indrawing.
- Oxygen saturation of 95% or less on room
- Grunting
- Decreased feeding.
- Irritability or lethargy.
- Cyanosis (in severe infection).
- Lower lobe pneumonias can cause abdominal pain. ^(4,5,6)

TREATMENT APPROACHES

1. ANTIBIOTICS

AMINOGLYCOSIDES

Aminoglycosides are the most commonly prescribed drugs for treating respiratory tract infections. The most frequently used aminoglycoside antibiotic for children is Amikacin. ⁽⁹⁾ Aminoglycosides works by inhibiting the protein synthesis by binding to the 16s r RNA and thereby disrupt the integrity of the bacterial cell membrane. The main resistance mechanisms of the aminoglycosides are;

- Deactivation of the aminoglycosides by N-acetylation, adenylation.
- Reduction in the intracellular concentration of aminoglycosides, thereby changes in the outer membrane.
- Changes in the 30s ribosomal subunit target through mutation.
- Methylation which occurs at the aminoglycoside binding sites. ⁽⁸⁾

Amikacin is the best choice of medicine against the gram-negative bacillary infections especially in children and infants. Amikacin is very effective against in-vitro and in-vivo organisms, multiply-resistant to kanamycin, gentamycin, tobramycin. Amikacin is usually administered in children as IM and IV at a dose of 10mg/kg as initial and followed by 7.5mg/kg every 12hours. It is said to be safe in children, because the immediate side effects have not been a problem. Also the drug is well tolerated among the aminoglycoside antibiotics. ⁽⁹⁾

CEPHALOSPORINS AND BETA- LACTAMASE INHIBITORS

Cephalosporins and beta-lactamase inhibitors were the most commonly preferred combination therapy for respiratory tract infections in children. The spectrum of activity of cephalosporins may increased due to the addition of beta-lactamase inhibitors. This combination represents a new logical approach to the widespread problem of antibiotic resistance due to beta-lactamase producing pathogens. ⁽¹⁰⁾

Cephalosporins are the broad-spectrum antimicrobial agents which are mainly used to treat the bacterial infections. It is very active against gram-positive and gram-negative bacteria. Production of beta-lactamase may cause bacterial resistance to the cephalosporins and may reduces their action.⁽¹¹⁾ For that purpose, beta-lactamase inhibitor (Sulbactam) is added to the cephalosporins, in order to inhibit the action of beta-lactamase enzyme and thereby prevent the bacterial resistance to cephalosporins. Thus the action of cephalosporins may increases due to sulbactam.⁽¹⁰⁾

2. INHALED CORTICOSTEROIDS

Inhaled corticosteroids are found to be very effective in treating the upper respiratory tract infections as well as asthma in paediatrics. Budesonide was the mostly preferred inhaled corticosteroids in children and it has a wide range of actions. Corticosteroids acts by enhancing the beta-adrenergic response to relieve the muscle spasm. They also acts by other mechanisms, it includes:

- Reversing the mucosal edema.
- Decreases vascular permeability through vasoconstriction.
- Inhibit the release of LTC₄ and LTD₄.

Corticosteroids play an essential role in the reduction of mucus secretion. They may inhibit the late phase reaction by inhibiting inflammatory response. The eosinopenic effect of corticosteroids may help to prevent the action of inflammatory mediators released from released from eosinophils. They prevents the increased airway reactivity with late bronchial reactions by blocking the late reaction. The inhaled formulation of steroid therapy are found to be safe with less systemic side effects.⁽¹²⁾

3. INHALED BRONCHODILATORS

Inhalational therapy with bronchodilators are very effective in children in treating respiratory tract infections. Usually preferred bronchodilators for inhalational therapy are salbutamol, albuterol etc. These medications belong to the class bronchodilators, specifically, Beta-2 adrenergic agonists. The Beta-2 adrenergic agonists are said to be the cornerstone of bronchodilator therapy. They actively relaxes the airway smooth muscles through a cyclic-AMP mediated decrease in myoplasmic Ca²⁺ content. These beta-2 adrenoceptor agonists exhibit inhibitory activity against a wide range of bronchoconstrictors.⁽¹³⁾

The inhalational therapy has a number of advantages over the other therapies. If we are giving a drug through inhalational route, especially for those drugs which exert their biological effect in lungs, then it may shows rapid onset of action. And also through the inhalational route, less dose is needed to administer and thereby the side effects of the drug can be reduced as compared with the oral route.⁽¹⁴⁾

4. ANTI-PYRETICS

Fever in paediatric patients can worsen the Upper Respiratory Tract Infections. URTI in children, is mostly characterized by a rapid onset of fever. Fever may increases host resistance to infection, and interventions to reduce fever may negatively affect the outcome of illness. Physicians mostly prescribe paracetamol (Acetaminophen) parenterally as an anti-pyretic to reduce fever in children. According to the Current World Health Organization, they recommend to use paracetamol for treating children with fever more than $\geq 39^{\circ}\text{C}$. It is also helpful to prevent harmful effects like febrile seizures and to relieve the symptoms.⁽¹⁵⁾

5. EXPECTORANTS

Expectorants are usually prescribed by the physicians in order to treat the symptoms of Lower Respiratory Tract Infections in children. It is mainly used for the coughing up of sputum, thereby cause relieve of cough. Expectorants like guaiphenesin causes increased mucus secretion. They works as irritants to gastric vagal receptors, which may trigger efferent parasympathetic reflexes which

cause glandular exocytosis of a less viscous mucus. Thereby, cough may be provoked. This action may reduce dyspnoea and improve breathing. ⁽¹⁶⁾

6. BACTERIAL IMMUNOSTIMULANTS

The recent studies show that bacterial immunostimulants may enhance the resistance to bacterial infections. The recently used bacterial immunostimulant is Broncho-Vaxom or OM-85. It is a lyophilized extract from 8 respiratory bacteria. They are:

- H. influenzae
- Diplococcus pneumoniae
- K. pneumoniae
- Staphylococcus aureus
- S. pyogenes
- Klebsiella pneumoniae
- Streptococcus viridans
- Moraxella catarrhalis

Their actions are to activate the different systems in the chain of immunological defence reactions. These actions can be said to be pleiotropic immunomodulating effects. These agents are especially indicated for young children, who are suffering from at least 3 respiratory tract infections per winter season. ⁽¹⁷⁾

CONCLUSION

The commonly used medicines in the treatment of Respiratory Tract Infections in paediatrics are antibiotics like aminoglycosides, cephalosporins, anti-pyretics, inhaled bronchodilators and corticosteroids, expectorants, bacterial immunostimulants etc. These agents are found to be safe and efficient in children with Lower Respiratory Tract Infections and their symptoms. Among these drugs, antibiotics were the most commonly prescribed drug by physicians. Aminoglycosides are useful for treating severe respiratory tract infections. Antibiotic use in childhood URTIs remains continuous and 90% of the infections are of viral etiology. Also, herbal remedies were implemented for the prevention of these infections in children. ⁽¹⁸⁾

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