Journal of Biomedical Sciences
Research Article Peer-review, Open Access

# Treatment of Atypical Macrolide-Resistant Pneumonia in Pediatric Patients

**Dr. Korab Hoxha** [1]

**Abstract:** Chronic diseases appear at all times, and in different forms. One of the most widespread and dangerous diseases is pneumonia. So pneumonia is an infection that inflames the air sacs in one or both lungs. The causes of the appearance of this disease can be seen from the pain caused to those affected by pneumonia. Pneumonia disease appears Inside the lungs, forming as an air sac filled with fluid or pus, fever, chills and difficulty breathing. So inside the lungs, many micro-organisms are formed, including bacteria, viruses and vile fungi, all of which can be the cause of pneumonia. So this disease is present to a large extent in babies and young children, and also in people over 65 years old, as well as people with health problems or a weak immune system. Newborns and infants may show no signs of infection. Or they may vomit, have a fever and cough, seem restless or tired and have no energy, or have difficulty breathing and eating. So every person affected by this virus should be careful and in this case visit the doctor if there is difficulty in breathing, chest pain, persistent fever with a temperature of 39°C or higher, or persistent cough, especially if you cough with pus. I will present in detail the treatment of pneumonia in the content of this paper.

**Key words:** pneumonia, virus, causes, treatment, rehabilitation.

[1] University of Tetovo, Department of Medicine, Tetovo, Macedonia



## Introduction

Atypical pneumonias are pneumonias characterized by atypia in the clinic, causative microorganisms, laboratory tests and imaging. Atypical pneumonia is responsible for about 15-30% of pediatric pneumonias worldwide.

Causes: Mycoplasma pneumoniae, Chlamydophila pneumoniae and Legionella pneumophila are the most common pathogens responsible for atypical pneumonias in children. In most cases, M. pneumoniae infections in children are mild and self-limited and only a small percentage of patients require hospitalization.

Clinical: The most common symptom is a dry cough that persists for several days to weeks, along with mild fever, fatigue, headache and mild dyspnea. Infection with Mycoplasma pneumoniae can also cause extrapulmonary manifestations such as skin rash or gastrointestinal symptoms.

Diagnosis: The diagnosis of atypical pneumonia is made by a combination of clinical examination, laboratory tests, and imaging studies. The gradual onset of the disease and the lack of specific symptoms can make early diagnosis difficult. Tachypnea, diffuse crepitations on auscultation, and wheezing may be detected during physical examination. Chest X-ray images show a diffuse interstitial infiltrate, otherwise known as reticulonodular shadow. Hemogram, CRP, and pathogen-specific tests such as PCR and ELISA are among the most useful laboratory tests.

Treatment: Children with atypical pneumonia should be treated with antibiotics. Typically, macrolides such as Azithromycin and Clarithromycin are used as first-line treatments because of their effectiveness against common atypical pathogens and their favorable safety profile. Tetracycline antibiotics and quinolones are recommended as alternative antibiotics when treating patients with Macrolide Resistant Mycoplasma Pneumonia (MRMP) infections. Supportive therapy includes hydration, rest, and antipyretics for fever. Antitussives may be used if persistent dry cough interferes with sleep or daily activities, and bronchodilators, such as Albuterol, may help with breathing or bronchospasm, especially in cases of Mycoplasma pneumoniae. Although their use is controversial, corticosteroids may be considered in severe cases with marked inflammation.

**Methodology** – The research of this paper is of the type "review of existing literature" and is based on various scientific publications from the scientific paper database "PubMed". All source data are cited in the references section.

In 2016, Lung et al. published recommendations for the treatment of children with community-acquired pneumonia (CAP), stating that (1) clinicians should consider MRMP when in children with pneumonia caused by M. pneumoniae macrolide therapy is ineffective and does not improve. (2) CAP associated with MRMP should be treated with doxycycline in children over the age of 8 years; (3) doxycycline should be used when the benefits outweigh the risks in children aged 8 years and older with CAP associated with MRMP; and (4) Fluoroquinolones are an alternative to doxycycline for children aged 8 years and older. A 2021 American study by Lanata et al. studied the prevalence of macrolide-resistant Mycoplasma pneumoniae infections in children in Ohio, a low incidence of 2.8%. They also found that children with resistant infections had longer hospital stays and a higher probability of requiring intensive care. Leng et al. in 2023 studied the molecular characteristics and treatment options for macrolide-resistant Mycoplasma pneumoniae in children and highlighted doxycycline as an effective treatment option. A systematic review and meta-analysis by Ahn et al. evaluated the efficacy of tetracyclines and fluoroquinolones for the treatment of macrolide-refractory pneumonia caused by Mycoplasma pneumoniae in children. This study showed that these antibiotics may be effective alternatives. Zhu et al. in 2023 explored the potential of galacto-oligosaccharides as antimicrobial agents against macrolide-resistant and susceptible strains of Mycoplasma pneumoniae. The results suggested that these compounds could offer a new approach to managing infections, especially in the era of increasing resistance rates.

Although not usually recommended for children, tetracyclines (doxycycline or minocycline) and fluoroquinolones are the only options for patients with macrolide-resistant M. pneumoniae infection until new drugs effective against macrolide-resistant strains become available.

Safety of tetracyclines and fluoroquinolones in children

In general, tetracyclines have few adverse effects, but in rare cases they can cause gastrointestinal upset, esophagitis, photosensitivity and hepatotoxicity, and hypersensitivity. The affinity of tetracyclines for minerals makes them susceptible to deposition in bones and teeth, thus causing stains in children. Therefore, tetracyclines are contraindicated in pregnancy and in children under 8 years of age. However,

studies show that children taking short courses may experience minimal tooth discoloration, making them a good candidate for use when there is no alternative for serious infections. Compared with minocycline, doxycycline binds calcium less, reducing tooth discoloration, and minocycline is more likely to cause adverse reactions.

Although fluoroquinolones are effective, they are not usually recommended for children because of musculoskeletal side effects such as arthritis, arthralgia, tendinopathy, and, very rarely, tendon rupture. In early studies in children treated with levofloxacin, joint problems were more common in the first two months, but no long-term difference was observed compared with other treatments. The risk of tendon rupture in adults is associated with factors such as age, steroids, hypercholesterolemia, and taste disorders. CNS symptoms (e.g., seizures, dizziness, hallucinations), peripheral neuropathy, cardiotoxicity, and glucose imbalance are rare side effects of fluoroquinolones. If there are no safer alternatives for infections caused by macrolide-resistant pathogens, fluoroquinolones represent a tolerable alternative.

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