v. 4, n. 61, 2024

International Journal of Health Science

EFFECTIVE PREVENTION STRATEGIES AGAINST RESPIRATORY SYNCYTIAL VIRUS IN PEDIATRIC

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Abstract: Objective: To analyze effective strategies to reduce Respiratory Syncytial Virus (RSV) infections in children. Method: A literature review was conducted using the PubMed database, with terms such as "Respiratory Syncytial Virus", "Pediatrics", "Prevention strategies", and "Incidence reduction". Of the 167 articles found, exclusion criteria reduced the selection to 12 articles for detailed analysis. Review: Several strategies against RSV infection were identified, including the use of monoclonal antibodies such as palivizumab, in addition to the development of active vaccines and the promotion of maternal vaccination. It is essential to increase parental awareness about RSV and implement affordable and effective prevention tactics that encompass non-pharmacological measures and consider socioeconomic factors. Conclusion: Prevention strategies, such as vaccination and immunoprophylaxis, are crucial, highlighting advances such as nirsevimab and vaccines for mothers. Additional research is needed to evaluate the effectiveness and safety of these approaches, especially in vulnerable populations, to guide efficient public health policies.
Keywords: immunoprophylaxis; respiratory Syncytial Virus; pediatric Prevention.

INTRODUCTION

RSV is a viral pathogen that stands out as one of the main causes of serious respiratory diseases in children under 5 years of age. Studies indicate that, annually, there are more than 33 million cases of RSV infection in this age group worldwide, resulting in approximately 3.2 million hospital admissions. RSV is notorious for being one of the main etiological agents of bronchiolitis and pneumonia in children, with significant implications for child health and healthcare systems due to the high cost of hospitalizations

and the considerable emotional impact on affected families (Tam et al., 2019).

Currently, immunoprophylaxis against RSV is predominantly carried out using the monoclonal antibody palivizumab. However, limited access to this treatment, due to high costs and administration complexities, highlights the need to develop more accessible alternatives. Recently, significant advances have been achieved with the development of nirsevimab, a long-lasting monoclonal antibody, and the efficacy of maternal RSV vaccines, which represent promising prospects for the prevention of this infection (Mineva, Purtill, Dunne, Philip, 2022). Additionally, the implementation of non-pharmacological interventions during the COVID-19 pandemic has demonstrated substantial reductions in RSV circulation, emphasizing the effectiveness of preventive public health measures (Na'Amnih et al., 2022).

Age is a critical risk factor for severe RSV infections, especially in infants younger than 6 months, alongside predisposing medical conditions and environmental factors. These findings reinforce the continued need for research and in-depth investigation into immunoprophylaxis against RSV, with the aim of improving preventive strategies and, consequently, reducing the incidence and morbidity associated with this respiratory infection in children. Considering the substantial impact of RSV infections on the healthcare system and the quality of life of affected children, the rationale for conducting studies that explore new approaches to preventing these infections is clear and urgent (Mineva, Purtill, Dunne, Philip, 2022).

The aim of this study is to analyze and synthesize the most recent evidence on interventions and preventive measures used to reduce the incidence and severity of Respiratory Syncytial Virus infections in children. This study aims to provide a comprehensive overview of effective prevention strategies in this vulnerable population, highlighting the importance of new research and innovative approaches in the field of pediatric public health.

METHODOLOGY

The methodology of this study consists of a systematic bibliographic review developed based on the PVO strategy, adapted to address: Population or research problem (Respiratory Syncytial Virus infections in pediatrics), Intervention (prevention strategies), Comparison (not applicable), and Outcome (reduction in the incidence and severity of respiratory infections). The guiding question was: "What are the most effective strategies for preventing Respiratory Syncytial Virus (RSV) infections in pediatrics, and how are these approaches influencing the incidence and severity of respiratory infections in children?"

To carry out the searches, the PubMed - MEDLINE (Medical Literature Analysis and Retrieval System Online) database was used. The search strategy included the following Boolean terms and operators: (("Respiratory Syncytial Virus" OR "RSV") AND ("Pediatrics" OR "Childhood" OR "Children") AND ("Prevention strategies" OR "Preventive measures" OR "Interventions") AND ("Incidence reduction" OR "Severity reduction" OR "Severity prevention")). This initial search resulted in the identification of 167 articles.

The inclusion criteria were defined as articles written in English or Portuguese, published between 2019 and 2024, that focused on the target population of children and adolescents and that were of the review or meta-analysis type, available in full. The exclusion criteria eliminated duplicate articles, articles available only in abstract form, and those that did not directly address the research question or that did not meet the other inclusion criteria.

After rigorously applying these selection criteria, the number of relevant articles was reduced to 97. Of these, 12 articles were finally selected to compose the study collection, all available in the PubMed database. This methodology allowed for a careful and updated analysis of prevention strategies against Respiratory Syncytial Virus in a pediatric context, enabling a clear assessment of how such interventions can reduce the incidence and severity of respiratory infections in children, thus contributing to the formulation of clinical guidelines. more effective.

DISCUSSION

VACCINATION AND IMMUNOPROPHYLAXIS AGAINST RSV

According to Frenkel, Gaur and Bellanti (2023), in the United States and specifically in the state of Massachusetts, several monoclonal immunoglobulins have been developed, however, their effectiveness has been limited. Furthermore, clinical trial analyzes indicate that Palivizumab reduced the risk of hospitalization for RSV infection in only 50% of high-risk children, without significantly impacting the reduction in overall mortality. The efficacy of this monoclonal antibody in preventing RSV infection in premature infants was also considered modest (Biagi et al., 2020). Therefore, the evaluation of these immunoprophylaxis faces challenges associated with randomized clinical trials, which require large samples to detect statistically significant effects (Driscoll et al., 2020). Furthermore, immunization also offers additional benefits, such as the prevention of secondary pneumonia caused by other infectious agents and a significant reduction in inappropriate antibiotic use, contributing to a healthier lung clinical status (Feikin et al., 2023).

Gatt et al. (2023) note that monoclonal antibodies were the pioneering passive immunization strategy to prevent RSV infections. In babies in the high-risk group, the use of Palivizumab resulted in a 40% reduction in the need for hospitalization, a 50% reduction in hospitalization days, and a 60% reduction in oxygen demand, although it caused adverse reactions in 5% of cases. Palivizumab reduced the hospitalization rate for RSV infections by 56%. However, it has disadvantages such as high cost and limited duration of effectiveness. Motavizumab, which has a greater affinity for the pathogen, was not superior to Palivizumab and was not approved by the FDA due to its tendency to cause skin rashes. Suptavumab was not shown to be effective enough in phase 3 clinical trials. On the other hand, Nirsevimab was approved in the European Union for the prevention of the disease in newborns and infants in their first RSV season, reducing lower respiratory tract infections associated with the pathogen by 70% and hospitalizations by 78%.

Although there is not yet a commercially available vaccine for active immunization against Respiratory Syncytial Virus (RSV), several candidates are currently in the research phase. Formats being tested include particle, vector, subunit and attenuated virus (LAV)-based vaccines. According to Biagi et al. (2020), a maternal F nanoparticle vaccine against RSV has shown efficacy in reducing hospitalization and infection in young children, reaching phase three clinical trials, while other candidates are still in early stages of development. The combination of passive immunization, through maternal vaccination or monoclonal antibodies (mAbs), followed by pediatric active immunization, may be an effective strategy to prevent serious RSV infections in young infants. Some of the bivalent RSV vaccines are designed to offer protection against RSV-A and RSV-B subtypes,

thus increasing the potential efficacy of these interventions (Frenkel; Gaur; Bellanti, 2023).

According to Gatt et al. (2023), of the 34 RSV vaccines in development, 21 are advancing to phase 3 clinical trials. Three vaccines based on recombinant vectors are among the candidates in advanced stages of clinical trials and target both the elderly and children. Despite concerns about the increased risk of thromboembolic events, it is believed that these vaccines may be successful. Nucleic acid vaccines, despite having shown remarkable safety and efficacy against SARS-CoV-2, still require additional studies when targeting RSV. A protein-based vaccine intended to provide protection through maternal vaccination was unsuccessful in preventing significant RSV infections when administered to pregnant women between 28 and 36 weeks of gestation, as demonstrated by studies that did not observe a reduction in the rate of infections clinically significant in the lower respiratory tract in the first 90 days of the baby's life. On the other hand, live-attenuated vaccines (LAV) have shown great promise, with one study highlighting that the five most promising vaccines were 88% effective against acute lower respiratory illnesses, offering significant protection to older babies who were not adequately protected by a mAb. or maternal vaccine.

Mortensen and Harrod-Lui (2022) highlight the importance of parental knowledge about RSV and its prevention for acceptance of new childhood immunizations. A survey carried out with 5,627 parents from different countries revealed that only 35% had some understanding about RSV, which led to reduced adherence to immunization. Therefore, it is essential that healthcare professionals undertake multidisciplinary efforts to educate about the safety, efficacy, and durability of these new RSV tools to improve public acceptance and understanding.

COMPARATIVE ANALYSIS OF COSTS AND EFFECTIVENESS OF MATERNAL VACCINATION AND MONOCLONAL ANTIBODIES AGAINST RSV

The cohort study by Baral, Higgins, Regan, and Pecenka (2021) compared the effectiveness and cost of maternal RSV vaccination and the use of monoclonal antibodies (mAbs) administered to young children. The results demonstrate that mAbs have greater efficacy, ranging from 60% to 70%, lasting up to six months. In contrast, the maternal vaccine showed an efficacy of 40% to 50%, with a duration of protection of three months.

This analysis was carried out in low- and middle-income countries, where the average annual cost was US$1,342 for the maternal vaccine and US$431 for mAbs. Thus, mAbs proved to be more cost-effective compared to the maternal vaccine.

Finally, as indicated in the study by Koltai et al. (2023), RSV prevention through these biological products will be more viable if prices are more affordable. This analysis highlights the importance of accessible and effective prevention strategies to mitigate the impact of RSV, particularly in low- and middle-income regions where the disease burden is significant and resources are limited. The choice between maternal vaccination and mAbs must consider not only effectiveness and costs, but also the accessibility and sustainability of providing these interventions.

NON-PHARMACOLOGICAL MEASURES TO PREVENT AND CONTROL RSV INFECTIONS

The prevention and control of RSV infections are relevant topics in public health, especially due to the limited effectiveness of available pharmacological treatments. In this context, the implementation of non-drug strategies is increasingly crucial for reducing cases and deaths related to RSV, in addition to contributing significantly to reducing hospitalizations and complications associated with these infections (Azzari et al., 2021).

Mineva, Purtill, Dunne and Philip (2022) highlight the importance of breastfeeding in preventing RSV infection, especially in the first months of life. The practice of breastfeeding, in addition to offering safety and protection, is accessible and economical, providing excellent cost-benefit. However, the effective promotion of breastfeeding faces challenges, particularly in low-income countries and in certain cultures where this act is stigmatized, including in developed nations. These obstacles impede optimal promotion of breastfeeding, which is crucial for both preterm and full-term babies (Mineva; Purtill; Dunne; Philip, 2022).

Hardelid et al. (2019) evaluated approximately 789,484 children, of whom approximately 11,782 were hospitalized due to RSV complications. The research revealed that the majority of hospitalizations occurred among children under six months of age. Although those born prematurely or with adjacent pathologies are among the at-risk population, they represented a smaller portion of hospitalizations. Socioeconomic factors, such as early motherhood, maternal involvement in criminal activities, and parental history of serious mental health or addiction problems, have been associated with a high number of RSV hospitalizations. Thus, the importance of considering clinical and social risk factors is highlighted when determining patients eligible for prophylaxis and immunization measures, such as palivizumab.

Living with older siblings has also been identified as a significant risk factor for RSV infection, due to the high probability of transmitting the disease through frequent physical contact and lack of hygiene habits. Maternal and older sibling vaccination has emerged as a promising strategy in developed countries, suggesting the need for a strict vaccination schedule during pregnancy to ensure the protection of newborns, including premature

babies (Hardelid et al., 2019).

FINAL CONSIDERATIONS

This review addresses prevention strategies against RSV, highlighting immunoprophylaxis, vaccination and non-pharmacological measures essential to reduce its incidence and severity in children. We highlight advances with the use of monoclonal antibodies, such as palivizumab and nirsevimab, and maternal vaccines, which have demonstrated efficacy in reducing transmission and morbidity. However, there is still a need for more comprehensive studies on the long-term effectiveness of these interventions and their accessibility. Future research must also focus on vulnerable populations and cost-effectiveness analyzes to guide health policies and improve the use of public health resources. Continued research is crucial to developing effective and affordable RSV preventive strategies.

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