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CONTRIBUTION OF MULTIPLEX PCR PANEL TO THE AETIOLOGICAL DIAGNOSIS OF ACUTE RESPIRATORY INFECTIONS IN CHILDREN: EXPERIENCE FROM CHEIKH KHALIFA AND MOHAMMED VI UNIVERSITY HOSPITALS

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ABSTRACT

Background: Acute respiratory infections (ARIs) are a leading cause of paediatric consultations and hospital admissions, especially in low- and middle-income countries. Viral pathogens account for 80–90% of cases, yet distinguishing between viral and bacterial aetiologies remains clinically challenging. **Objective**: To evaluate the utility of multiplex PCR panels in identifying respiratory viruses in children hospitalised with ARIs. **Methods**: We conducted a prospective, observational study from October 2021 to March 2023 in two university hospitals in Casablanca. Children aged 0–15 years with fever ≥38°C and respiratory symptoms were included. Nasopharyngeal swabs were analysed using a multiplex PCR panel targeting common respiratory viruses. **Results**: Among 64 children enrolled, the mean age was 21.6 months. At least one respiratory virus was detected in 73.2% of cases. The most frequent pathogens were respiratory syncytial virus (RSV, 31.2%) and rhinovirus (20.3%). Co-infections occurred in 12.5% of cases. Clinical evolution was favourable in most patients. **Conclusion**: Multiplex PCR is a valuable tool for the rapid and reliable identification of respiratory viruses in children. Its integration in routine practice could enhance diagnostic accuracy and rationalise antibiotic use.

KEYWORDS: Multiplex PCR, paediatric respiratory infections, respiratory syncytial virus, viral co-infection, molecular diagnostics.

1. INTRODUCTION

Acute respiratory infections (ARI) are among the leading causes of pediatric consultations, both in hospitals and primary care settings. They are a major cause of morbidity and mortality in children, especially in low- and middle-income countries. In children under five years of age, lower respiratory tract infections such as bronchiolitis, pneumonia, and bronchitis are commonly encountered and may result in prolonged hospitalizations.

Respiratory viruses are responsible for 80 to 90% of cases, particularly in the early stages. These include respiratory syncytial virus (RSV), influenza and parainfluenza viruses, adenoviruses, rhinoviruses, metapneumoviruses, and coronaviruses. In children under one year of age, more than 40% of hospitalizations for respiratory infections are due to viral etiologies. However, despite the viral predominance, distinguishing between viral and bacterial infections based solely on clinical findings remains challenging.

The emergence of molecular biology techniques, particularly multiplex PCR, has revolutionized the etiological diagnosis of respiratory infections. These panels allow the simultaneous detection of multiple pathogens with high sensitivity and specificity, in a reduced timeframe. Their use in pediatric settings is of increasing interest, both for improving management and for better understanding the local epidemiology of viral infections.

The objective of our study is to evaluate the contribution of multiplex PCR in identifying respiratory viruses in

children hospitalized for ARI in two university hospitals in Casablanca: Mohammed VI International University Hospital and Cheikh Khalifa International University Hospital.

2. MATERIALS AND METHODS

This is a prospective, observational, monocentric study conducted in two university hospitals in Casablanca: Mohammed VI International University Hospital and Cheikh Khalifa International University Hospital.The study was conducted from October 2021 to March 2023 and included children hospitalized for acute respiratory infection. Inclusion criteria were: children aged 0 to 15 years, hospitalized with a body temperature ≥ 38°C for less than seven days, and presenting at least one of the following symptoms: cough, rhinorrhea, nasal congestion, snoring, or signs of lower respiratory tract involvement (dyspnea, crackles, respiratory distress, suggestive chest radiography).

Exclusion criteria included: patients with known chronic respiratory conditions (e.g., asthma, cystic fibrosis), children who had received antibiotics within 48 hours prior to sampling, and cases with uninterpretable or incomplete samples. For each included patient, the following data were collected using a standardized form: demographic data (age, sex), relevant medical history, clinical signs on admission, paraclinical data (CRP, radiography, etc.), and clinical outcome. A nasopharyngeal swab was performed for each patient within the first 24 hours of admission. Samples were sent to the National Reference Laboratory for Virology for analysis. Pathogen identification was carried out using a multiplex PCR panel (kit name if known), allowing simultaneous detection of several respiratory viruses: RSV, rhinovirus, influenza A/B, adenovirus, coronavirus, metapneumovirus, and parainfluenza. Data were entered and analyzed using Excel software.

3. RESULTS

A total of 64 children were included in the study, comprising 34 boys (53.1%) and 30 girls (46.9%), resulting in a male-to-female sex ratio of 1.13. The mean age of the patients was 21.63 ± 27.62 months, ranging from 1 month to 16 years. Infants under 6 months of age represented the most affected age group, accounting for 32.6% of the cohort.

Regarding medical history, 18.7% of the children (n=12) were born prematurely, 17.1% (n=11) had a personal history of atopy, 3.1% (n=2) had congenital anomalies, and one child (1.6%) had a known immunodeficiency. The predominant clinical features observed at admission were cough in 93.7% of patients (n=60), rhinorrhoea in 73.4% (n=47), signs of respiratory distress in 46.9% (n=30), and fever in 45.3% (n=29). Multiplex PCR analysis allowed for the identification of at least one respiratory virus in 73.2% of the cases (47 out of 64 children). The most frequently detected viruses were respiratory syncytial virus (RSV) in 31.2% of cases (n=20), followed by rhinovirus in 20.3% (n=13), influenza A virus in 6.2% (n=4), adenovirus in 4.6% (n=3), and coronavirus in 3.1% (n=2). Co-infections, defined as the simultaneous detection of two or more viruses, were observed in 12.5% of patients (n=8). The most common combinations were RSV with rhinovirus (37.5% of co-infections), RSV with influenza A (25%), and RSV with coronavirus (12.5%).

A raised C-reactive protein (CRP) level, defined as >20 mg/L, was recorded in 36% of the children. Chest radiographs revealed radiological signs of pulmonary involvement in 41% of cases, ranging from interstitial infiltrates to more localised condensations. Notably, one patient aged 30 months presented with a subtotal lobar opacity(Annexe 1). The overall clinical outcomes were favourable. More than 90% of the children recovered without the need for invasive ventilation, indicating a predominantly mild-to-moderate clinical course despite the high viral burden.

Figures 1.

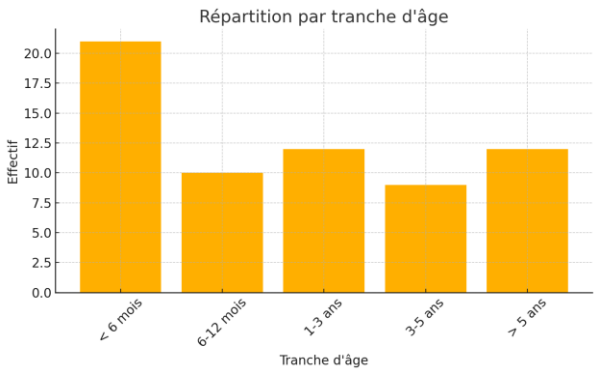

Figure 2.

4. DISCUSSION

Acute respiratory infections (ARIs) are a common reason for paediatric hospitalisation, particularly in children under the age of five. The severity of these infections, their frequent occurrence, the wide range of implicated viruses, and the limitations of clinical diagnosis alone justify the growing interest in rapid and reliable molecular techniques, such as multiplex respiratory PCR.

In our cohort of 64 children, there was a slight male predominance (34 boys vs 30 girls; sex ratio 1.13). Such

a trend is frequently reported in the literature concerning viral respiratory diseases, likely due to hormonal and immunological factors. The mean age was 20.3 months, with a predominance of cases in the <6-month to 3-year age group— the most vulnerable period. These findings are consistent with those of Lin et al.[1] and Bianchini et al.[2], who reported that severe forms of bronchiolitis and viral pneumonia occur mostly in children under 3 years of age. Over one-third of the children had at least one identified risk factor: prematurity (18.7%), atopic background (17%), congenital anomalies (3%), or known immunodeficiency (1.5%). These conditions not only increase susceptibility to viral respiratory infections but are also associated with a higher risk of complications. As highlighted by Bianchini et al.[2], prematurity is one of the recognised criteria for prophylaxis against RSV using palivizumab. The predominant clinical features were cough (93.7%), rhinorrhoea (73.4%), respiratory distress (46.8%), and fever (45.3%). While consistent with classic viral infection presentations, these symptoms alone do not allow definitive aetiological identification. Williams et al.[3] noted that viruses such as RSV and metapneumovirus often present with similar clinical profiles, reinforcing the need for biological confirmation.

Our use of a multiplex PCR panel allowed for the detection of at least one respiratory virus in 73.2% of patients. RSV was the most frequently identified pathogen (31.2%), followed by rhinovirus (20.3%) and influenza A (6.2%). These results align with those reported by Sherif et al.[4] and Timbrook et al.[5], who consistently found RSV and rhinovirus as the leading viral agents in children. The Saudi study by AlGhanmi et al.[6] documented an unusual extension of viral seasons post-COVID, with sustained circulation of rhinovirus/enterovirus, influenza A, and adenovirus—findings that are in line with our own. The diagnostic performance of multiplex PCR confirms its utility in enabling rapid and accurate pathogen identification, which can reduce hospital stay durations and prevent inappropriate treatments. Co-infections were identified in 12.5% of our cases. The most common combinations were RSV with either rhinovirus or influenza A. These findings corroborate those of Henrickson et al.[7], who reported that over 20% of children harboured multiple viruses, particularly in moderate to severe forms. Co-infections often complicate clinical presentations and may require closer monitoring. An elevated C-reactive protein (CRP >20 mg/L) was observed in 36% of children. In some of these cases, PCR clearly indicated a viral origin (e.g., RSV, rhinovirus), confirming the data of Nishikawa et al.[8], who reported that viruses like adenovirus can elicit a high CRP, while others, such as SARS-CoV-2, are associated with minimal systemic inflammation. Therefore, CRP should not be used in isolation to guide antibiotic decisions and must be interpreted in light of virological findings. Radiological abnormalities were seen in 41% of cases, ranging from interstitial patterns to focal consolidations. As illustrated in the OPTIPAC study by Cantais et al.[9], a positive PCR result alongside non-specific chest radiography often enables clinicians to withhold empirical antibiotic treatment and provides reassurance about the viral nature of the infection. Our study supports the growing value of multiplex PCR in the diagnosis of paediatric respiratory infections—particularly in moderate to severe cases, in high-risk children, and during epidemic periods. It also underscores the importance of integrating clinical, biological, and radiological data to optimise therapeutic decisions. Incorporating multiplex PCR into antibiotic stewardship programmes, as suggested by Weis et al.[10], represents a promising strategy to rationalise antibiotic use and improve overall patient care.

5. CONCLUSION

Acute respiratory infections in children remain a major public health concern due to their high frequency, clinical variability, and potential severity especially in infants and young children. Our study highlights the significant contribution of respiratory viruses, particularly RSV and rhinovirus, as the predominant pathogens in hospitalised paediatric cases. The implementation of multiplex PCR has proven to be an invaluable diagnostic tool, enabling the rapid and accurate detection of respiratory viruses, even in the context of co-infections. Its use allows for a better understanding of local viral epidemiology and supports more targeted therapeutic decisions, helping to avoid unnecessary antibiotic use. Moreover, the integration of molecular diagnostics with clinical, radiological, and biological findings enhances the overall quality of care and contributes to antimicrobial stewardship strategies. In resource-limited settings, such diagnostic advances represent a crucial step toward more rational and efficient management of respiratory infections in children. Future studies with larger sample sizes and multi-centre designs would be valuable in confirming these findings and assessing the cost-effectiveness of systematic PCR use in paediatric respiratory diagnostics.

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