Serodiagnosis of Acute Respiratory Infections in Children in Georgia

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ABSTRACT

Objective. To investigate the etiology of acute respiratory infections in hospitalized children.

Methods. A total of 808 children were studied. Investigation of RSV, Adenovirus, Parainfluenza, Influenza A and B, C.trachomatis, C.pneumoniae, M. pneumonia and Legionella were performed with an ELISA for IgM, IgG and IgA antibodies detection.

Results. There were 496 males and 312 females giving a male: female ratio of 1.6:1. Ages range from 1 month to 15 years. The overall detection rate was 57.9%. The most frequently detected were: parainfluenza 12.6%, adenovirus 11.2%, influenza A 7.3%, RSV 6%, M. pneumoniae 5.4%, C.trachomatis 3.5% and mixed-infections 9.2%. Pneumonia was associated most frequently with adenovirus and mixed-infections; wheezing bronchitis - with adenovirus, RSV and M. pneumoniae; bronchitis - with parainfluenza and adenovirus, diseases of upper respiratory tract - with parainfluenza and adenovirus. Peak of the virus activity was during winter (influenza, parainfluenza, adenovirus, RSV) and autumn (parainfluenza, RSV).

Conclusion. Viruses are the main causes of ARI in Georgian children. A better understanding of the etiology of ARI in all of the regions of the world may be helpful for timely decision of specific therapy, which can help pediatricians to estimate and manage children with ARI. [Indian J Pediatr 2006; 73 (7) : 569-572] E-mail: ivane_ch@internet.ge

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Acute respiratory infections are the leading cause of mortality and morbidity in children. More than 10 million children die each year and in the developing countries 21% (14-24%) of deaths are attributed to pneumonia alone. More then 200 viral species are associated with respiratory tract disease in humans and this number is increasing almost each year. The etiology of ARI varies according to countries' economic conditions as well as their geo-regional locations. Determination of the ARI etiology is a challenge, because the diagnostic tests of respiratory samples that are non-invasively obtained are insufficiently sensitive to identify the causative agent.

In most cases of ARI it is often difficult to identify the infective etiology. The various diagnostic techniques used for identification of the etiologic agents: blood culture, lung puncture, nasopharyngeal aspirates, serological tests, immuno-assays, PCR. Lung puncture is an invasive procedure associated with significant morbidity; nasopharyngeal aspirates can be used for detection of viruses, but the possibility of concomitant bacterial lower respiratory tract infection (LRTI) cannot be ruled out with confidence; the PCR are costly, still experimental and not available for routine use.

Most of the studies from developing countries for the identification of the etiological agents for ARI were directed towards one pathogen either bacteria, viruses or atypical organisms, in either upper or lower respiratory tract. There is paucity of papers that studied all of the etiological agents in patients with the ARI of both, upper and lower respiratory tracts.

Below is our report of the experience of the investigation of the etiological agents for ARI in hospitalized children under 15 who were studied for infection with viruses and atypical pathogens.

MATERIALS AND METHODS

A prospective trial was designed to evaluate the etiology of upper and lower respiratory tract infections in hospitalized children. The study protocol was approved...
by Ethics Committee of M. Guramishvili Pediatric Clinic. The study was explained to the parents and they signed the informed consent form. The inclusion criteria were: age from 1 month to 15 years; community acquired upper or lower RTI; presence of cough with/without fever which lasted for less than 2 weeks; tachypnea or chest retraction and pulmonary infiltrates on CXR. We excluded children with nosocomial LRTI and those, who were immunocompromised. Acute upper and/or lower respiratory tract infections were defined as an illness with the following signs and symptoms: history of cough, tachypnea, strydar, fever, chest retraction, moaning, perioral cyanosis, wheezing, and rales. Acute obstructive laryngitis (croup), nasopharyngitis and pharyngitis were considered as upper respiratory tract infections; pneumonia, bronchitis and wheezing bronchitis as a lower respiratory tract infections. Clinical diagnosis of pneumonia was made by physical examination and confirmed by chest x-ray and pulse-oximetry.

Data was recorded and managed on excel spreadsheet. The SPSS 11.0 computer software for windows was used for statistical analyses. 808 children, who were admitted at M. Guramishvili Paediatric Clinic from the period 1997-2003, were enrolled in the study.

At the first study visit, a full history was taken from the parents. A full clinical examination was performed for all children, and birth weight, feeding history, full medical history, including details of all respiratory symptoms were taken.

The following investigations were performed within 24 hours of admission: full blood count, blood chemistry tests, chest x-ray and pulse-oximetry. Acute and convalescent serum samples were tested by ELISA for IgM and IgG antibodies to RSV, adenovirus, influenza A and B, parainfluenza 1-3 virus and cytomegalovirus. Acute infection was diagnosed if the child had a significant antibody response to one of the viruses in blood sera (an IgM-specific antibody titre <1:100 or a fourfold increase in IgG antibody in paired sera), according to previously described criteria. The presence of Chlamydia trachomatis, Chlamydia pneumoniae, Mycoplasma pneumoniae and Legionella pneumophila were defined by a significant antibody response - for Mycoplasma pneumoniae specific IgM ≥1:100, or a 4-fold increase in IgG titer in paired serum samples; for chlamydiae: specific IgA ≥1:16, or a 4-fold increase in IgG titer. Reagents: ImmunoLISA, Orgenics (Israel); ABL (Germany) detected on the Hiperion MRIII (USA) and Labsystem Multiskan MCC/340 (Finland). A positive infection was defined either in a single test or in paired sera taken 2-3 weeks apart.

RESULTS

A total of 808 children fulfilling the inclusion criteria were investigated. There were 496 males and 312 females giving a male: female ratio of 1.6:1. Ages range from 1 month to 15 years, with the majority of patients (18.5%) being in the 1-3 years age group. The rate of the ARI in the first six months was almost the same in comparison with the second six months of life.

The age distribution of respiratory tract infections is shown on a Table 1. It is seen that the rate of respiratory viruses decreased in older age groups (142 in age up to 1 year, 114 in age from 1 to 3 and 45 in age more than 3 years). On the contrary, the rate of the mixed-infections increased in accordance with the age (18, 21, 35 consequently).

<table>
<thead>
<tr>
<th>Infective agents</th>
<th>Age of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-6 month</td>
</tr>
<tr>
<td>Virus</td>
<td>62</td>
</tr>
<tr>
<td>Atypical path.</td>
<td>14</td>
</tr>
<tr>
<td>Mixed-infection</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
</tr>
</tbody>
</table>

The age distribution of the ARI caused by viral agents is shown in Fig. 1. It is clear, that the incidence of parainfluenza and RSV decreased according to the age, the rate of influenza is lowest in the age group up to 6 months, and adenovirus is occurring predominantly in the age from 1 to 3 years.

![Fig. 1. Association of viral agents with age of patients](image)

At least one pathogen was identified in 468 cases, so the overall detection rate was 57.9%. The features of serodiagnoses of these patients are shown in Table 2.

The number of virus-positive patients was 301 (37.2%). Among them more frequently detected were: parainfluenza 102 (12.6%), adenovirus 91 (11.2%), influenza A 59 (7.3%), RSV 49 (6%).

In 93 (11.5%) patients were identified atypical pathogens, among them Mycoplasma pneumoniae 44 (5.4%), Chlamydia trachomatis 29 (3.5%), Chlamydia pneumoniae 18 (2.2%), and Legionella 2 (0.2%).

In 74 (9.2%) patients were established mixed-infections, among them in 64 (7.9%) patients viral-viral and in 10 (1.2%) viral-atypical infections.

As for other pathogens, it is noteworthy the comparatively high rate of detection of CMV infection (10 cases, 1.2%).