

THE CONCORDANCE BETWEEN THE X RAY IMAGE AND RESPIRATORY PATHOLOGY AT INFANTS YOUNGER THAN 3 MONTHS OLD

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Abstract: *In the medical literature there are issues when an X ray image by a radiologist and by a pediatrician. We wanted to evaluate the concordance between the X-ray image and lower tract respiratory infections of the newborn and young infant (<3 month.). We have studied 260 patients younger than 3 month that have been hospitalized between 01.01.2015 and 31.01.2016 at Clinical Hospital of Children Brasov, and divided in 3 groups by diagnosis: non alveolar pneumonia, alveolar pneumonia and bronchiolitis. 48.7% were diagnosed by the X ray image with non-alveolar pneumonia, 14,23% with alveolar pneumonia and 37,69% with bronchiolitis. The demographic data were not statistically significant in regard of the following type of birth, gestational age, WBC (white blood cell count) and CRP ($p>0,05$). The alveolar pneumonia was more frequent in the infants from rural area than those from the urban one ($p=0,01$). Most patients with pneumonia were newborns ($p=0.0002$). The concordance between the x-ray image and the final diagnosis was 81,08% for the alveolar pneumonia, 93,6% for the non-alveolar pneumonia and only 7,14% for bronchiolitis.*

Key words: *X ray, infant, pneumonia, bronchiolitis..*

1. Introduction

In the medical literature there are some debates when interpreting of a X-ray image by a radiologist and by a pediatrician. The purpose of the study was to evaluate of the concordance between the X ray image and the respiratory pathology of the newborn and young infant [4], [2].

2. Method and Material

We undergone a retrospective study that comprised of 260 patients younger than 3 month of age. All of them have been hospitalized in the Clinical Hospital of Children – Brasov between 01.01.2015 and 31.01.21016. By diagnosis, the patients were divided in three different groups: the

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first one comprised of 37 patients diagnosed with alveolar pneumonia, the second one of 124 patients with non-alveolar pneumonia and the third one with 98 patients diagnosed with bronchiolitis. The X ray images were first interpreted by the pediatrician and then by the radiologist. The inclusion criteria in this study were: age (<3 month) and the presence of clinical signs and symptoms of lower tract respiratory infections along with the X-ray criteria of X ray of WHO. Exclusion criteria were: those immunodepressed and those with cardiac malformations. All data were collected from the charts after the obtaining of the informed consent from the legal tutors of all the patients. We noted the gender, the age at admission, demographic data, type of birth, the gestational age, feeding type, the WBC count among with the percentage of neutrophils and lymphocytes, the CRP absolute value, X-ray image and the type of antibiotics used. The statistics was performed using Microsoft Office Excel 2007; Of statistical relevance was considered a $p < 0,05$.

3. Results

From the total of 260 children included in this study, 124 of them (48.07%) were diagnosed by the aspect of the X ray image with non-alveolar pneumonia, 37 (14,23%) with alveolar pneumonia and 98 (37,69%) with bronchiolitis. The concordance between demographics and the radiologic diagnoses are depicted in Table 1. The alveolar pneumonia was more frequently encountered at patients from country side

($p=0,01$); both types of pneumonia (alveolar and non-alveolar) have affected new-borns more than those with ages from 5 to 8 weeks and beyond 8 weeks ($p=0,0002$).

Complete blood count, along with the absolute value of leucocytes was normal in 59,45% of the children with alveolar pneumonia, 95,16% of the children with non-alveolar pneumonia and 92,85% of cases with bronchiolitis. Leucocytosis was frequently seen in patients with alveolar pneumonia (15 cases), in 7 of those cases leucocytosis was associated with elevated neutrophils.

Inflammation markers at admittance, C-reactive protein was positive (≥ 5 mg/dl) in only 2 cases from the total of 260 patients studied. Mean value of C-reactive protein was 1,28 mg/dL in the patients with alveolar pneumonia, 0,79 mg/dl in those with non-alveolar pneumonia and 0,6 mg/dl in those with bronchiolitis. The X ray images we studied, in all 3 types of pulmonary pathologies are represented in Figure 1. Of all 260 patients, there were identified 18 with positive rapid antigenic test for Syncytial Respiratory Virus (RSV); 6 of them were diagnosed with non-alveolar pneumonia, 8 with bronchiolitis and 4 with alveolar pneumonia. Diagnostic concordance between radiologist-pediatrician was 81.08% in the alveolar pneumonia, 93,6% in the non-alveolar pneumonia and 7,14% in bronchiolitis (Figure 2).

Table 1

The absolute and procentual frequency of cases by the x-ray image and the demographics

Total	Alveolar Pneumonia		Non-alveolar pneumonia		Bronchiolitis		P
	Absolute No.	% of total cases	Absolute no. of cases	% of absolute no. of cases	Absolute no. of cases	% of absolute no. of cases	
	37		124		98		
Gender							0,84
Male	18	48,64	63	50,8	46	46,93	
Female	19	51,36	61	49,2	52	53,07	
Environmental origin							0,01
Country-side	29	78,37	65	52,41	54	55,1	
City	8	21,63	59	47,59	43	44,9	
The age at spitalization (weeks)							0,0002
≤4 (newborn)	27	72,97	89	71,77	44	44,89	
5 - 8	5	13,51	25	20,16	41	41,83	
8	5	13,51	10	8,06	13	13,26	
Gestational age (weeks)							0,93
< 38	9	24,32	34	27,41	26	26,53	
≥ 38	28	75,68	90	72,59	72	73,47	
Type of birth							0,14
Natural	32	86,48	88	70,96	70	71,42	
Caesarean operation	5	13,52	36	29,04	28	28,58	
Type of alimentation							0,19
Breast-fed	19	51,35	62	50	38	38,77	
Artificial of mixt	18	48,65	62	50	60	61,22	

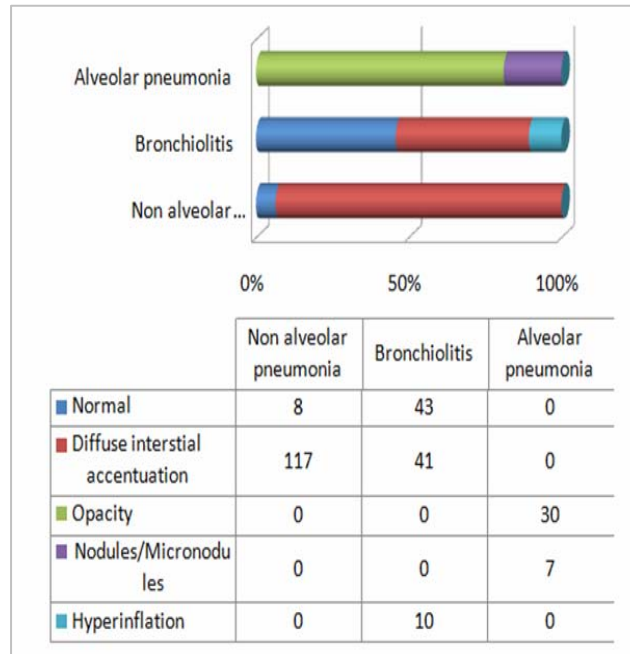


Fig. 1. *The absolute and procentual frequencies of the radiologic types of images in the low respiratory tract infections*

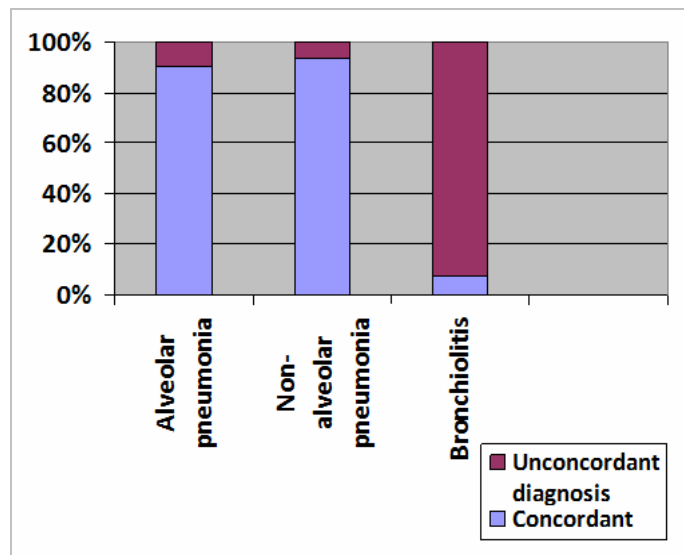


Fig. 2. *The diagnosis concordance between radiologist- pediatrician*

Antibiotic therapy in our study cohort looks as follows: 99,2% of the patients with non-alveolar pneumonia have received antibiotics, all of the alveolar

pneumonia were treated with antibiotics and only 11,22% of the patients with bronchiolitis received antibiotics. The most used antibiotics were: Aminopenicillins

(Ampicillin especially), second generation Cephalosporins (especially Cefuroxime), third generation of Cephalosporins (especially Ceftriaxone) and Aminoglycosides (Gentamicin) as it is depicted in Figure 3.

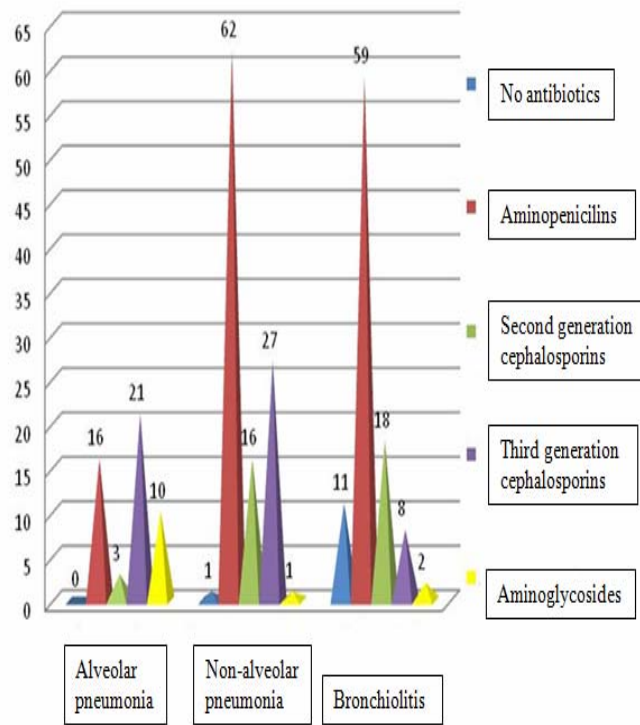


Fig. 3. *The antibiotics used and their frequency according to the pathology*

4. Discussions

A similar study with 1,232 children enrolled (but their age was under 2 years) showed that the clinical diagnosis at hospitalization was bronchiolitis in 66.7%, pneumonia in 15.3%, and wheezy bronchitis in 18.1% [2]. If we group the pneumonia with wheezy bronchitis in that study, the results are just opposite to our study. We have a total of 62,3% cases of pneumonia and 37,7% cases of bronchiolitis and they have 66,7% cases of bronchiolitis and 33,4% cases of pneumonia. We observed that the patients diagnosed with non-alveolar and alveolar pneumonia in our study were mostly

newborns, and these results are concordant with other studies, where the authors state that the infection with RSV (the most frequent cause of bronchiolitis) is rare in newborns [8].

Alveolar pneumonia was significantly frequentier encountered in patients from country-side, most probably because those patients have precarious conditions. Also, they come from a long distance, have a reduced accessibility to the medical services and have a higher risk for severe infections. When they arrived in our services there is a higher probability to be hospitalized rather than to be treated ambulatory [15].

Despite the fact that *Falagas et al.* said that low respiratory tract infections affects more often the male gender [6], we did not observed any differences in regard of gender.

Other studies such as *Shantini et. Al* and *Friedrich et al.* state that lower gestational age is associated with higher respiratory infections incidence, [12],[7] which we did not found in our study. We found that there are no differences between preterm and term babies regarding the incidence of lower respiratory tract infections. However one limitation of our study is the small number of children included and also the fact that it was retrospective.

The type of birth is another important aspect that can influence the incidence of lower respiratory tract infections. *Magnus et al.* demonstrated that children delivered by caesarian section are at an increased risk of developing wheezing, asthma and low respiratory tract infections [11]. In contrast we did not observed any differences between children delivered vaginally and those delivered by caesarian section in regard of bronchiolitis and pneumonia.

Although several studies demonstrate that exclusive breast feeding reduces the risk of gastrointestinal and low respiratory tract infections, in our study we found no difference in the incidence of respiratory infections between exclusively breastfed and partially breastfed and formula fed infants [5], [10], [3].

The researches on animal models showed a synergism between the viral respiratory infections and a secondary bacterial infection, and *Ampofo et al.* demonstrated a temporal correlation between the seasonality of the viral infections with RSV, metapneumovirus and influenza virus and the invasive pneumococcal disease [1], but this viral-

bacterial coinfection is estimated <2%. *Resch et al.* highlights the frequent concerns of clinicians about these severe complications in the young infants with fever and infiltrates in the X ray image [14].

Juve et al. managed the identification of the germs implicated in community-acquired- pneumonia in only 85% of cases and the co-infection could be demonstrated in only 30% of cases and the most frequent bacteria implicated was the pneumococcus [9].

There are several studies that demonstrated that high values of C-reactive protein are encountered even in bronchiolitis without the proof of a bacterial coinfection [14]. In our study, the C-reactive protein value was negative at the moment of hospitalization in most of the cases, regardless of the pathology and with medium values close to each other in all three low respiratory tract pathologies. So we consider its value in the choice of the appropriate therapy was really low.

Pucell et al. showed that the absolute number of leukocytes have a very low predictive value (<5,7%) for a concomitant bacterial co-infection in the infants with low-respiratory tract infection with RSV [1]. Similarly, the absolute value of leukocytes in our study was normal in over 90% of cases with non-alveolar pneumonia and bronchiolitis.

The chest X ray image is a key element in diagnosing lower respiratory tract infections at infants under the age of three month, but in some of the cases there is a debate in its interpretation between the radiologist and the pediatrician.

Smith and Openshaw stressed the fact that there may be an uncommon X ray image in bronchiolitis, with hyperinflation and parcellar atelectasis, and for that, the differential diagnosis between this image

and those with consolidations is very difficult. This explains why antibiotic therapy at the hospitalization time is influenced [15].

A study that included only patients with bronchiolitis showed that the X ray image made in the moment of hospitalization itself attracts the diagnosis of pneumonia and the decision of using antibiotics, in contrast to the patients with no X ray chest images and the positive clinical diagnosis of bronchiolitis. Similarly, our study showed a reduced diagnosis concordance in case of bronchiolitis, highlighting the need of correct clinical data associated with correct investigations.

However, a high percentage of children with bronchiolitis or viral pneumonia are treated with antibiotics unjustified [14].

Also, in our study, from the 98 patients with bronchiolitis, only 11 were treated without antibiotics, suggesting a high rate of using the antibiotics for this lower tract infection [15].

5. Conclusions

- 1 In our study we found reduced concordance in diagnosing low respiratory tract infections between radiologist – pediatrician – laboratory in case of bronchiolitis, while, for pneumonia cases the diagnosis concordance was above 80%.
- 2 We consider that there is still a need for better concordance of X ray images in cases of bronchiolitis between Peds – Radiologists.
- 3 The absolute value of C- reactive protein and leukocytes in the moment of hospitalization were normal in most of the cases and their utility in the establishment of the diagnosis and therapy was low.

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