EURASIAN JOURNAL OF HEALTH SCIENCES
e-ISSN 2651-3501
Eurasian JHS 2023; 6(1): 11-15

Research Article/
Araştırma Makalesi

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Platelet to Lymphocyte Ratio In Respiratory Syncytial Virus Infection

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ABSTRACT

Respiratory syncytial virus (RSV) is a viral pathogen that causes respiratory system infections in childhood. In this study, we aim to examine the role of Platelet to lymphocyte ratio (PLR) and Platelet to Lymphocyte and monocyte ratio (PLT/LY+MO) values in the prediction of RSV infection and in the differentiation of upper and lower respiratory tract RSV infections. Complete blood counts and RSV Antigen test results of 76 patients, between the age of 0 and 12 were investigated retrospectively. PLR values are calculated using Platelet Count/Lymphocyte Count formula, whereas PLMR values are calculated using Platelet Count/Lymphocyte Count+Monocyte Count. Out of 76, 32 patients were diagnosed as having RSV infection due to RSV antigen test. The percentage lymphocyte and monocyte as well as the platelet count were significantly higher in RSV positive group. Monocyte percentage in lower respiratory tract RSV infection was significantly lower compared to upper respiratory tract RSV infection. Our study revealed that blood parameters like lymphocyte and monocyte percentage and platelet count may be an important clue for the clinician for RSV infection and also, play a role as a guide before advanced techniques. In addition, percentage of monocyte can be useful to detect the lower respiratory tract involvement in RSV infection.

Key words: Lymphocyte, Platelet, Platelet to Lymphocyte Ratıo, Respiratory Syncytial Virus.

Respiratuvar Sinsityal Virüs Enfeksiyonunda Platelet Lenfosit Oranı

ÖZ

Respiratuar sinsityal virüs (RSV), çocukluk çağında solunum sistemi enfeksiyonlarına neden olan viral bir patojendir. Bu çalışmada Trombosit/lenfosit oranı (PLR) ve Platelet/Lenfosit oranının (PLT/LY+MO) RSV enfeksiyonunun ön tanısında ve üst-alt solunum yolu RSV indfeksiyonlarının ayrımındaki rolünü incelemeyi amaçladık. 0-12 yaş arası 76 hastanın tam kan sayımı ve RSV Antijen test sonuçları geriye dönük olarak incelenmiştir. PLR değerleri Trombosit Sayısı/Lenfosit Sayısı formülü kullanılarak hesaplanırken, PLMR değerleri Trombosit Sayısı/Lenfosit Sayısı+Monosit Sayısı kullanılarak hesaplanmıştır. RSV antijen test sonuçlarına göre 76 hastanın 32'sine RSV enfeksiyonu teşhisi konmuştur. RSV pozitif grupta lenfosit ve monosit yüzdesi ile trombosit sayısı anlamlı derecede yüksek bulunmuştur. Alt solunum yolu RSV enfeksiyonunda monosit yüzdesinin ise üst solunum yolu RSV enfeksiyonuna göre anlamlı derecede düşük olduğu saptanmıştır. Çalışmamız lenfosit ve monosit yüzdesi ile trombosit sayısı gibi kan parametrelerinin RSV enfeksiyonu için klinisyene bir ipucu verebileceğini ve ayrıca ileri teknikler öncesinde yol gösterici rol oynayabileceğini ortaya koymuştur. Ek olarak, monosit yüzdesinin, RSV enfeksiyonunda alt solunum yolu tutulumunu saptamak için faydalı olabileceği sonucuna varılmıştır.

Anahtar kelimeler: Lenfosit, Platelet, Platelet Lenfosit Oranı, Respiratuvar Sinsityal Virüs.

DOI: 10.53493/avrasyasbd.1100884 Received: 11.04.2022 Accepted: 18.10.2022

INTRODUCTION

Respiratory Syncytial Virus (RSV) is a member of the Paramyxoviridae family that causes respiratory tract infections in children, particularly in infants. It primarily causes lower respiratory tract infections in children under the age of two (e.g., bronchiolitis, pneumonia). The incubation period ranges from 2 to 8 days. Beginning with coryza, mild cough, fever, lethargy, and decreased appetite, the symptoms of the infection progresses to noisy, raspy breathing and a wheezy cough. Physical examination may reveal a prolonged expiratory phase, wheezing, tachypnea, dyspnea, and tachycardia. The diagnosis is based on the patient's history and physical examination findings. RSV can be identified by rapid tests or viral isolation. For infants, nasal wash is one of the methods used to obtain the specimen. Although rapid antigen testing is commercially available, it is generally not recommended due to its ineffectiveness in diagnosis. Furthermore, the virus's genetic material can be identified using RT-PCR, which is usually more sensitive than antigen testing or viral culture. RSV virus can be identified using viral cultures, however, cultures are expensive and time consuming (Dawson-Caswell et al., 2011; Handforth et al.,2000; McCarthy et al.,2003; Leung et al., 2005; Ruubsamen-Waigmann H et al., 2003; Centers for Disease Control and Prevention, 2018; Gern JE, 2008; Respiratory Syncytial Virus Testing, 2018).

This research is aimed to examine how PLR (Platelet to lymphocyte ratio) and PLT/LY+MO (Platelet to Lymphocyte and monocyte ratio) values are affected by RSV infection and as well as to determine whether there is a difference between upper and lower respiratory track RSV infections.

MATERIAL AND METHOD

The study was carried out in 2021 and 76 patients aged 0 to 12 admitted to the TOBB ETU Faculty of Medicine Department of Pediatrics between 2013 and 2020 with respiratory tract symptoms were included, retrospectively. Thirty-two patients among 76 were pre-diagnosed with RSV infection and had further laboratory investigations. Patients with clinical symptoms and X-ray findings consistent with bronchitis, bronchiolitis, and pneumonia were classified as having a lower respiratory tract infection, while others had an upper respiratory tract infection.

Blood samples were collected into 2-mL (K2) EDTA vacutainer tubes (Becton Dickinson, USA) for CBC and into 8,5-mL SSTTM II Advance vacutainer tubes (Becton Dickinson, USA) for serological analysis. All whole blood samples were kept at room temperature (18–25°C) until testing and were processed within 30 minutes from venipuncture. Sera were separated after centrifugation at 4500 rpm for 10 minutes, stored at 2-8°C and analysed for CBC and RSV antigen on the same day.

CBC was analyzed using Sysmex XT2000i (Sysmex Co., Japan). Lymphocyte count and percentage (LY#, LY%), monocyte count and percentage (MO #, MO%), leukocyte count (LEU#) and platelet count (PLT #) were evaluated.

RSV antigen was detected by using one step combo card test (CerTest RSV+Adenovirus Resp., Biotec S.L., Zaragoza,Spain) which is a qualitative colored chromatographic immunoassay for the simultaneous detection of RSV and Adenovirus from nasal swab, nasopharyngeal wash or aspirate specimens. Internal procedural controls are included in the tests. The green lines appearing in the control lines (C) are internal controls, which confirm sufficient specimen volume and correct procedural technique. The tests were done within 30 minutes after the collection of nasal swabs.

PLR values are calculated using Platelet Count / Lymphocyte Count formula, whereas PLMR values are calculated using Platelet Count / Lymphocyte Count + Monocyte Count.

Mean, median and standard deviation (SD) values for LY#, LY%, MO#, MO%, LEU#, PLT# and PLR, PLMR are calculated individually for each group.

The distribution of the data was tested using Kolmogorov-Smirnov test. Appropriate statistical tests were used according to the distribution characteristics of the data. Comparisons of two groups were made either by using t test for independent samples where the data distributed normally or by using Mann-Whitney U test if the data distribution was not normal. Chi-square test was used for comparisons of frequency distributions.

Since the study was planned retrospectively, it was carried out with the study and ethical aspect approval of the Medical Director of TOBB ETU Health Education Application and Research Center (3417/2022).

RESULTS

Thirty-two patients out of 76, were found to have RSV infection due to a positive RSV antigen test result. The data of the patients were shown in the Table 1.

Table 1. Comparison of parameters for RSV (+) and RSV (-) groups

	RSV (-) (n=44)	RSV (+) (n=32)	T	Sig. (2-tailed)
LY# †	4,28 ± 2,18	5,46 ±2,29	-1,968	0,053
LY%†	41,59 ± 17,32	54,48 ±15,88	-3,239	0,002
MO#†	1,14 ±0,63	1,27 ± 0,48	-0,678	0,500
MO%†	10,44 ±3,62	13,03 ±4,28	-2,672	0,009
LEU#†	11,15 ±4,98	10,02 ± 2,84	1,300	0,198
PLT#†	332,54 ±131,86	395,77 ±116,11	-2,097	0,039
PLT/LY†	91,33 ± 46,47	83,11 ±36,48	0,634	0,528
PLT/(LY+MONO) †	70,75 ±37,21	65,44 ±26,14	0,468	0,641

† Mean ± SD, Student's t test

The mean age of the patients who were RSV negative was greater than those who tested positive for RSV. Regarding gender, there was no difference between the groups (Table 2). The RSV positive group had significantly higher CBC values in terms of LY% (t=-3,239 p=0,002), MO% (t=-2,672 p=0,009), and PLT# (t=-2,097 p=0,039), whereas the other parameters (LY#, MO#, LEU#, PLR and PLMR) were similar.

Table 2. Demographic characteristics of groups

	RSV (+) (n=32)	RSV (-) (n=44)	*p*
Age (Months)	13,6±28,4	21,1±23,8	0,010*
Gender (Male:Female)	18 : 14	25 : 19	0,961**

*Mann-Whitney U test ** Chi-square test

Additionally, the parameters were also examined to see whether there is a difference between RSV positive patients with upper respiratory tract infections and those with lower respiratory tract infections. Six patients had upper respiratory infections, compared to 26 who had lower respiratory infections. Patients with lower respiratory tract RSV infection had considerably lower monocyte percentages than those with upper respiratory tract RSV infection (t=3,13, p=0,0004) (Table 3). We could not find any significant difference for PLR and PLMR in RSV infection.

Table 3. Comparison of parameters for upper and lower respiratory tract RSV infections.

	Upper respiratory tract (n=6)	Lower respiratory tract (n=26)	t or Z	*p*
LY# †	4,77 ± 1,91	5,557 ± 2,35	-0,77	0,444
LY%*	54,05 (31,10 - 67,60)	58,75 (16,30 - 535)	-0,77	0,440
MO#†	1,60 ± 0,55	1,18 ± 0,44	1,99	0,055
MO%†	17,27 ± 3,76	11,98 ±3,73	3,13	0,004
LEU#*	8,87 (6,05 - 13,57)	9,09 (5,44 - 17,67)	-0,72	0,469
PLT#†	365,67 ± 98,69	402,92 ± 118,16	-0,71	0,480
PLT/LY*	73,86 (58,99- 17,55)	75,21 (25,04- 203,76)	-0,29	0,772
PLT/(LY+MONO)*	52,63 (45,87 - 89,11)	63,90 (22,68- 139,69)	0	1,000

† Mean ± SD, Student's t test

DISCUSSION

Our data revealed similar results when compared to other viral infections. However, the lymphocyte percentage, monocyte percentage, and platelet counts are higher in the RSV positive group when compared to the RSV negative group. These values may be useful where advanced diagnostic RSV methods are not available.

Tayman et al. aimed to investigate the effect of eosinophil count, serum eosinophilic cationic protein (ECP) level, and

ECP/ eosinophil level in determined viral upper respiratory tract infection. They emphasized that asthma attacks are induced by viral infections, especially by RSV and found that inflammatory markers such as ECP levels, eosinophil count, and ECP/eosinophil ratio were not affected by the severity and causes of the attacks (Tayman C et al, 2010).

Tatli Gunes showed that in children with recurrent wheezing attacks, total eosinophil count, IL-13, and Ig E levels were similar in RSV positive and negative group. Serum IL-4 and IFN gamma levels were detected higher in RSV negative group (Tatli Gunes B, 2010).

In a study on children under the age of 2.5 with confirmed RSV infection, O'Donnel et al. discovered that children with RSV infection have significantly lower lymphocyte counts as well as higher absolute neutrophil and monocyte counts when compared to the control group (O'Donnell DR et al., 2002; 34).

De Weerd et al. investigated T cell subclasses in the peripheral blood of bronchiolitis patients. They examined T cell redistribution during RSV infection using data from 18 children under the age of 2 who had RSV-bronchiolitis. The control group consisted of 13 patients who did not have respiratory infection symptoms. The absolute counts of the CD8+T cells and the absolute counts of natural killer cells were significantly lower in the RSV positive group compared to the control group. The total count of lymphocytes, monocytes, neutrophils and T cell subsets did not significantly differ in RSV infection (De Weerd Wet al., 1998).

Hervás et al examined the data from 2384 patients with acute bronchiolitis to see if there were any clinical, management, or outcome differences between RSV positive and negative bronchiolitis. RSV rapid antigen test and/or virus culture were detected positive in 1495 of all cases. Leukocyte count was lower in RSV positive group, however, CRP and neutrophil percentage were not significantly different between the groups (Hervás D et al.,2012).

Gokce et al reported that MPV may be utilized for the diagnosis of RSV bronchiolitis due to the data of 184 children with acute bronchiolitis. However, they concluded that MPV is not a reliable marker in specifying the cause of acute bronchiolitis (Gokce S, 2019).

CONCLUSION

As a conclusion, although we could not find any difference for PLR and PLMR in RSV infection, our study revealed that the total blood count parameters like lymphocyte and monocyte percentage and platelet count may be an important clue for the clinician for RSV infection and also play a role as a guide before advanced techniques. In addition, percentage of monocyte can be useful to detect the lower respiratory tract involvement in RSV infection.

AUTHOR CONTRIBUTION

Idea/Concept:YAA, NA; Design: YAA, DT; Consultancy: NA; Data Collection and/or Processing: YAA, MT; Analysis and/ or Interpretation: YAA, MT; Literature Review: YAA, DT; Writing The Article: YAA, DT; Critical Review:NA

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FINANCIAL DISCLOSURE

The authors received no financial support for the research, authorship, and/or publication of this article.

REFERENCES

Dawson-Caswell M, Muncie HL, Respiratory Syncytial Virus Infection in Children, American Family Physician, 2011; 83(2): 141-146.

De Weerd W, Twilhaar WN, Kimpen JLL, T Cell Subset Analysis in Peripheral Blood of Children with RSV Bronchiolitis, Scand J Infect Dis, 1998; 30: 77-80. https://doi.org/10.1080/003655498750002349

Gern JE, Viral Respiratory Infection and the Link to Asthma, Pediatr Infect Dis J., 2008; 27(10 0) : 97-103. https://doi.org/10.1097/INF.0b013e318168b718

Gokce S, Kurugol Z, Koturoglu G, Aslan A, Polater S, Cicek C, Diagnostic Value of the Mean Platelet Volume in the Prediction of Respiratory Syncytial Virus in Acute Bronchiolitis, J Pediatr Res, 2019;6(1):51-55. https://doi.org/10.4274/jpr.galenos.2018.53325

Handforth J, Friedland JS, Sharland M, Basic epidemiology and immunopathology of RSV in children, Paediatric Respiratory Reviews, 2000; 1: 210–214. https://doi.

org/10.1053/prrv.2000.0050

Hervás D, Reina J, Yañez, del Valle JM, Figuerola J, Hervás JA, Epidemiology of hospitalization for acute bronchiolitis in children: differences between RSV and non-RSV bronchiolitis, Eur J Clin Microbiol Infect Dis, 2012; 31: 1975-1981. https://doi.org/10.1007/s10096-011-1529-y

Leung AKC, Kellner JD, Davies HD, Respiratory Syncytial Virus Bronchiolitis, Journal of the National Medical Association, 2005; 97(12): 1708-1713.

McCarthy CA, Hall CB, Respiratory Syncytial Virus: Concerns and Control, Pediatrics in Review, 2003; 24(9): 301-308. https://doi.org/10.1542/pir.24-9-301

O'Donnell DR, Carrington D, Peripheral Blood Lymphopenia and Neutrophilia in Children with Severe Respiratory Syncytial Virus Disease, Pediatric Pulmonology, 2002; 34: 128-130. https://doi.org/10.1002/ppul.10140.

Ruubsamen-Waigmann H, Deres K, Hewlett G, Welker R (2003). Viral Infections and Treatment. In: Informa Healthcare (Ed), 1ST ed., 95-98, Marcel Dekker Inc, New York.

Tatli Gunes B, Respiratuar Sinsityal Virüs İle Respiratuar Sinsityal Virüs Dışı Bronşiyolit Geçiren Çocuklarda Tekrarlayan Hışıltı, Atopi Riski Ve Serum İnterlökin-4, İnterlökin-13, İnterferon-Gama Düzeylerinin Karşılaştırılması, Dokuz Eylül Üniversitesi Tıp Fakültesi Çocuk Sağlığı ve Hastalıkları Anabilim Dalı, Thesis, İzmir, 2010.

Tayman C, Özmen S, Badur S, Arslan Z, Blood eosinophil counts, ECP levels, ECP/eosinophil ratios in the acute asthma exacerbations triggered by upper respiratory tract infections, Asthma Allergy Immunol, 2010; 8: 13-22.

Centers for Disease Control and Prevention, https://www.cdc.gov/rsv/about/index.html, 2018

Respiratory Syncytial Virus Testing, Available on line 2018: https://labtestsonline.org/understanding/analytes/rsv/tab/test/