

doi: 10.13241/j.cnki.pmb.2018.08.020

血常规联合 hs-CRP、免疫学指标检测在小儿急性上呼吸道感染中的临床价值*

闫学平¹ 郝秀丽² 孙 婷¹ 齐如艳¹ 李绍刚¹ 赵秋芬^{3Δ}

(1 北京市第一中西医结合医院 / 中国中医科学院中医基础理论研究所第一附属医院检验科 北京 100018;

2 北京市第一中西医结合医院 / 中国中医科学院中医基础理论研究所第一附属医院儿科 北京 100018;

3 北京首儿李桥儿童医院检验科 北京 101314)

摘要 目的:探讨血常规联合超敏 C-反应蛋白(hs-CRP)、免疫学指标检测在小儿急性上呼吸道感染中的临床价值。**方法:**以 2013 年 3 月至 2017 年 6 月我院收治的 185 例急性上呼吸道感染患儿为研究对象,根据病原体类型分为病毒组 87 例、细菌组 64 例、支原体组 34 例,并选择同期在我院体检的健康儿童 80 例作为健康组。检测和比较四组的白细胞计数(WBC)、血清 hs-CRP 和 T 淋巴细胞水平。**结果:**细菌组的 hs-CRP 水平和 WBC 高于其它三组($P<0.05$),病毒组和支原体组的 hs-CRP 水平高于健康组($P<0.05$),病毒组的 WBC 低于且支原体组的 WBC 高于健康组($P<0.05$),病毒组的 WBC 低于支原体组($P<0.05$);病毒组、细菌组和支原体组的 $CD4^+$ 和 $CD4^+/CD8^+$ 低于且 $CD8^+$ 高于健康组($P<0.05$),但病毒组、细菌组和支原体组组间差异无统计学意义($P>0.05$);WBC、hs-CRP 和 T 淋巴细胞联合检测的灵敏度和准确度高于各单项检测 ($P<0.05$),WBC、hs-CRP 和 T 淋巴细胞联合检测的灵敏度高于两两联合检测 ($P<0.05$),且准确度略高于两两联合检测,WBC、hs-CRP 和 T 淋巴细胞联合检测的特异度低于 hs-CRP 和 T 淋巴细胞单项检测($P<0.05$),且略低于 WBC 单项检测。**结论:**WBC 和 hs-CRP 有利于鉴别感染病原体的种类,急性上呼吸道感染患儿存在一定程度的细胞免疫失调,而在 WBC 和 hs-CRP 检测的基础上联合免疫学指标有利于提高对小儿急性上呼吸道感染的检测灵敏度和准确度。

关键词:小儿急性上呼吸道感染;血常规;hs-CRP;免疫学指标;临床价值

中图分类号:R562;R446 文献标识码:A 文章编号:1673-6273(2018)08-1502-04

Clinical Value of Blood Routine Combined with hs-CRP and Immunological Indicators for the Acute upper Respiratory Tract Infection in Children*

YAN Xue-ping¹, HAO Xiu-li², SUN Ting¹, QI Ru-yan¹, LI Shao-gang¹, ZHAO Qiu-fen^{3Δ}

(1 Laboratory, Beijing First Hospital of Integrated Chinese and Western Medicine/The First Affiliated Hospital of Chinese Academy of Traditional Chinese Medicine, Beijing, 100018, China; 2 Pediatric Department, Beijing First Hospital of Integrated Chinese and Western Medicine/The First Affiliated Hospital of Chinese Academy of Traditional Chinese Medicine, Beijing, 100018, China;

3 Laboratory, Beijing First Child Liqiao Children's Hospital, Beijing, 101314, China)

ABSTRACT Objective: To discuss the clinical value of blood routine combined with hs-CRP and immunological indicators for acute upper respiratory tract infection of children. **Methods:** A total of 185 children with acute upper respiratory tract infection from March 2013 to June 2017 were studied and divided into virus group (87 cases), bacteria group (64 cases), mycoplasma group (34 cases) according to the pathogen type. And 80 healthy children in our hospital were selected as health group. The white blood cell count (WBC), hs-CRP and T lymphocytes were analyzed of four groups. **Results:** The hs-CRP level and WBC of bacteria group was higher than other three groups ($P<0.05$), hs-CRP level of virus group and mycoplasma group were higher than health group ($P<0.05$), WBC of virus group was lower and mycoplasma group was higher than health group ($P<0.05$), WBC of virus group was lower than mycoplasma group ($P<0.05$); $CD4^+$ and $CD4^+/CD8^+$ of virus group, bacteria group and mycoplasma group were lower and $CD8^+$ was higher than health group ($P<0.05$), but there was no statistically significant difference between the virus group, bacterial group and mycoplasma group ($P<0.05$); The sensitivity and accuracy of WBC, hs-CRP and T lymphocytes joint detection were higher than single detection ($P<0.05$), and the sensitivity of WBC, hs-CRP and T lymphocytes joint detection was slightly higher than two joint detection, the specificity of WBC, hs-CRP and T lymphocytes joint detection was lower than single hs-CRP and T lymphocytes detection ($P<0.05$), and the specificity of WBC, hs-CRP and T lymphocytes joint detection was slightly lower than single WBC detection. **Conclusion:** The WBC and hs - CRP are helpful to identify the types of pathogen, acute upper respiratory children show cell immune disorders. Immunological index is helpful to improve detection sensitivity and accuracy of acute upper respiratory tract infection. The immunological indicators detection can improve

* 基金项目:国家卫生计生委临床科研专项(W2016EWQT39)

作者简介:闫学平(1965-),女,专科,主管技师,研究方向:临检,生化,库,免疫等,E-mail: yanxueping_1965@papmedline.club

Δ 通讯作者:赵秋芬(1953-),女,专科,副主任检验师,研究方向:生化,E-mail: zhaoqiufen_1953@papmedline.club

(收稿日期:2017-10-12 接受日期:2017-10-31)

the detection sensitivity and accuracy for acute upper respiratory tract infection of children based on blood routine combined with hs-CRP detection.

Key words: Acute upper respiratory tract infection of children; Blood routine; hs-CRP; Immunological indicators; Clinical value

Chinese Library Classification(CLC): R562; R446 **Document code:** A

Article ID: 1673-6273(2018)08-1502-04

前言

急性上呼吸道感染简称上感,又称"急性鼻咽炎"、"急性咽喉炎"、"急性扁桃体炎"^[1],主要由鼻、咽部发生病毒或细菌等感染引起^[2],可继发细菌感染^[3]。病原谱为病毒为主,其次是细菌、肺炎支原体和混合感染^[4]。该疾病四季均可发作,且发病次数不定,发病率约占儿科门诊患儿的60%以上,且具有一定的传染性^[5,6]。若诊治不及时,病原体可入侵鼻窦、气管、肺、颈淋巴结、中耳和眼等邻近器官,致使病情进一步加重。因此,对于急性上呼吸道感染的尽早诊断甚至明确是何种病原体感染致病对于临床及时、有效的针对性治疗尤为重要。

急性上呼吸道感染经典的病因诊断是病原学检测,但采集标本困难、实验条件要求高、耗时等致使其不能满足临床快速诊断及指导用药的需要^[7,8]。因此,临床实践中常采用血常规作为该病的诊断和病原体的鉴别方法。但白细胞计数(WBC)易受用药和基础疾病等因素干扰,且部分病毒性感染患儿的WBC也会大幅增高,易引起毒性感染误诊为细菌感染,导致抗生素过度使用^[9]。相关研究显示超敏反应蛋白(hs-CRP)可用于鉴别细菌与支原体或病毒感染^[10]。而免疫功能低下可能是引起小儿呼吸道感染的原因^[11],提示是否可将免疫功能指标作为诊断小儿急性上呼吸道感染的参考指标。因此,本研究探讨了WBC、hs-CRP和免疫学指标联合检测诊断小儿急性上呼吸道感染的临床价值,现报道如下。

1 资料与方法

1.1 一般资料

以2013年3月至2017年6月我院收治的185例急性上呼吸道感染患儿为研究对象。所有患儿均根据流行情况、病史和鼻咽部症状和体征,并结合周围血象和胸部X线检查确诊。其中男112例,女73例;年龄5个月~12岁,平均 $(3.8 \pm$

1.2)岁;病程12~72 h,平均 (18.6 ± 4.2) h;病毒感染87例(病毒组),细菌感染64例(细菌组),肺炎支原体感染34例(支原体组),三组的性别、年龄和病程等一般资料差异无统计学意义($P > 0.05$)。并选择同期在我院体检的健康儿童80例作为健康组,其中男36例,女24例;年龄5个月~12岁,平均 (4.2 ± 1.3) 岁。四组的性别和年龄等一般资料差异无统计学意义($P > 0.05$),具可比性。研究经患儿家属知情同意并签署知情同意书,并获医院医学伦理委员会批准。

1.2 指标检测

采集所有入组对象的清晨空腹静脉血4 mL。取2 mL加入EDTA-K2抗凝,以其中1 mL采用流式细胞仪检测CD4⁺、CD8⁺T淋巴细胞和CD4⁺/CD8⁺值,另1 mL采用全自动血细胞分析仪进行检测WBC。将上述剩余2 mL静脉血于3000 r/min离心10 min,取血清,采用免疫散射比浊法检测hs-CRP。以健康组相应指标水平为参考值。其中CD4⁺、CD8⁺和CD4⁺/CD8⁺以至少一个指标高于或低于参考值则判定为阳性。联合检测以其中一种指标达到阳性标准则判定为阳性。

1.3 统计学方法

采用SPSS18.0统计学软件进行数据分析,计量资料用 $\bar{x} \pm s$ 表示,组间比较采用LSD-t检验,计数资料用卡方检验,以 $P < 0.05$ 表示差异有统计学意义。

2 结果

2.1 四组血清hs-CRP水平和WBC水平的比较

细菌组的血清hs-CRP水平和WBC明显高于其它三组($P < 0.05$),病毒组和支原体组的血清hs-CRP水平显著高于健康组($P < 0.05$),病毒组的WBC低于健康组,且支原体组的WBC高于健康组($P < 0.05$),病毒组的WBC低于支原体组($P < 0.05$),见表1。

表1 四组血清hs-CRP水平和WBC比较($\bar{x} \pm s$)

Table 1 Comparison of the serum hs-CRP level and WBC among four groups($\bar{x} \pm s$)

Groups	n(case)	hs-CRP(mg/L)	WBC($\times 10^9/L$)
Health group	80	$1.82 \pm 0.43^{\circ \circ \circ}$	$6.78 \pm 1.33^{\circ \circ \circ}$
Virus group	87	$2.96 \pm 0.57^{\circ \circ}$	$4.51 \pm 1.24^{\circ \circ \circ}$
Bacteria group	64	$18.36 \pm 2.76^{\circ \circ \circ}$	$20.18 \pm 4.60^{\circ \circ \circ}$
Mycoplasma group	34	$3.72 \pm 1.45^{\circ \circ}$	$8.34 \pm 1.75^{\circ \circ \circ}$
P		0.000	0.000

Note: Compared with health group, $^{\circ}$ $P < 0.05$; compared with Virus group, $^{\circ \circ}$ $P < 0.05$; compared with bacteria group, $^{\circ \circ \circ}$ $P < 0.05$; compared with mycoplasma group, $^{\circ \circ \circ}$ $P < 0.05$.

2.2 四组T淋巴细胞水平比较

病毒组、细菌组和支原体组的CD4⁺和CD4⁺/CD8⁺低于健康组,且CD8⁺高于健康组($P < 0.05$),但病毒组、细菌组和支原

体组组间CD4⁺和CD4⁺/CD8⁺差异无统计学意义($P > 0.05$),见表2。

表 2 四组 T 淋巴细胞水平比较($\bar{x} \pm s$)

Table 2 Comparison of the T leukomonocyte level among four groups($\bar{x} \pm s$)

Groups	n(Case)	CD4 ⁺ (%)	CD8 ⁺ (%)	CD4 ⁺ /CD8 ⁺
Health group	80	38.62± 6.95	25.98± 4.77	1.52± 0.33
Virus group	87	30.19± 7.34*	29.46± 6.48*	1.14± 0.27*
Bacteria group	64	29.64± 7.78*	31.04± 7.12*	1.08± 0.32*
Mycoplasma group	34	31.23± 8.09*	29.87± 7.54*	1.27± 0.25*
P		0.001	0.007	0.013

Note: Compared with health group, * P<0.05.

2.3 WBC、hs-CRP 和 T 淋巴细胞及其联合检测对诊断小儿急性上呼吸道感染的结果评价

WBC、hs-CRP 和 T 淋巴细胞联合检测的灵敏度和准确度高于各单项检测(P<0.05), WBC、hs-CRP 和 T 淋巴细胞联合检

测的灵敏度高于两两联合检测(P<0.05), 且准确度略高于两两联合检测, WBC、hs-CRP 和 T 淋巴细胞联合检测的特异度低于 hs-CRP 和 T 淋巴细胞单项检测(P<0.05), 且略低于 WBC 单项检测, 见表 3。

表 3 WBC、hs-CRP 和 T 淋巴细胞及其联合检测对诊断小儿急性上呼吸道感染的结果比较(% , n=265)

Table 3 Comparison of the clinical value of WBC, hs-CRP and T leukomonocyte for the acute upper respiratory Tract Infection of Children(% , n=265)

Groups	Sensitivity	Specificity	Accuracy
WBC	60.54*	77.50	65.66*
hs-CRP	74.05*	82.50*	76.60*
T leukomonocyte	69.73*	81.25*	73.21*
WBC+hs-CRP	90.27*	67.50	83.39
WBC+T leukomonocyte	88.65*	71.25	83.39
hs-CRP+T leukomonocyte	91.35*	67.50	84.15
WBC+hs-CRP+T leukomonocyte	97.83	70.00	89.43
P	0.000	0.038	0.001

Note: Compared with WBC, hs-CRP and T leukomonocyte compared detection, *P<0.05.

3 讨论

小儿呼吸系统并未发育完善, 很容易受到病毒、细菌及其它病原体的入侵^[12]。因此, 呼吸道感染为小儿常见、多发病^[13,14]。由于大多数感染均表现为咳嗽、咳痰和发热等症状, 因此仅凭疾病表现很难对其进行准确诊断和鉴别^[15]。临床常通过对外周血进行血常规检测诊断呼吸道感染疾病, 而 WBC 是鉴别病毒和细菌感染的常规检查项目, 但白细胞数量受年龄、体温和情绪等影响较大。由于很多病毒感染、病毒细菌混合感染以及支原体感染患者的 WBC 在正常范围, 前者与后两者的差异不明显, 且白细胞正常范围较宽, 计数上升较慢, 其变化不能及时地反映病情, 易受用药和基础疾病等因素干扰^[16]。因此, 血常规检查非常必要, 但只能作为参考。

CRP 是机体受到感染或组织损伤后血浆中急剧上升的蛋白质, 可清除入侵机体的病原微生物以及损伤、坏死和凋亡的组织细胞, 而 hs-CRP 可提高试验的灵敏度、准确度。对抗病原体的入侵会致使感染后的机体免疫细胞陷入疲惫状态, 因此呼吸道感染患儿的免疫功能弱于正常健康儿童^[17]。而 T 淋巴细胞是机体免疫系统的重要组成部分, 不仅是免疫效应细胞, 还是免疫的调节细胞^[18]。作为 T 淋巴细胞的核心 CD4⁺、CD8⁺ 和 CD4⁺/CD8⁺ 值可以直观反映机体的免疫状态, 若机体处于免疫

抑制状态时, CD4⁺/CD8⁺ 会下降^[19]。

本研究检测了上呼吸道感染患儿和健康儿童的 WBC、hs-CRP 和 T 淋巴细胞水平, 并分析了三指标联合对小儿上呼吸道感染的诊断结果。结果显示细菌组的 hs-CRP 水平和 WBC 高于其它三组, 病毒组和支原体组的 hs-CRP 水平高于健康组, 病毒组的 WBC 低于且支原体组的 WBC 高于健康组, 病毒组的 WBC 低于支原体组, 提示 hs-CRP 和 WBC 可为小儿急性上呼吸道感染诊断提供一定依据^[20], 且 hs-CRP 水平和 WBC 鉴别细菌感染与病毒和支原体感染^[21], 而 WBC 可为鉴别病毒和支原体感染提供一定依据。此外, 病毒组、细菌组和支原体组的 CD4⁺ 和 CD4⁺/CD8⁺ 低于且 CD8⁺ 高于健康组, 但病毒组、细菌组和支原体组组间差异无统计学意义, 提示急性上呼吸道感染患儿可能存在免疫功能抑制和免疫细胞数目异常的状况^[22,23], 可能是因为当机体受到病原体感染时, 会激活免疫系统致使免疫细胞功能及数目异常^[24-26]。因此, 治疗时应依据患儿的免疫情况选择药物, 必要时可选择调节免疫的药物以促成患儿尽早康复^[27]。此外, WBC、hs-CRP 和 T 淋巴细胞联合检测的灵敏度和准确度高于各单项检测和两两联合检测, 提示在 WBC 和 hs-CRP 检测的基础上联合免疫学指标有利于提高对感染性疾病的检测灵敏度和准确度^[28-30]。

综上, WBC 和 hs-CRP 有利于鉴别感染病原体的种类, 急

性上呼吸道感染患儿存在一定程度的细胞免疫失调,而在WBC和hs-CRP检测的基础上联合免疫学指标有利于提高对小儿急性上呼吸道感染的检测灵敏度和准确度。

参考文献(References)

- [1] Voon K, Tan YF, Leong PP, et al. Pteropine orthoreovirus infection among out-patients with acute upper respiratory tract infection in Malaysia[J]. Journal of Medical Virology, 2015, 87(12): 2149-2153
- [2] Kumar KM, Anitha P, Sivasakthi V, et al. In silico study on penicillin derivatives and cephalosporins for upper respiratory tract bacterial pathogens[J]. Biotech, 2014, 4(3): 241-251
- [3] Moreno-Valencia Y, Hernandez-Hernandez VA, Romero-Espinoza JAI, et al. Detection and characterization of respiratory viruses causing acute respiratory illness and asthma exacerbation in children during three different seasons (2011-2014) in Mexico City [J]. Influenza & Other Respiratory Viruses, 2015, 9(6): 287-292
- [4] Simon A, Grosse-Onnebrink J. Acute respiratory infection in infants and young children: bacterial or viral origin? [J]. Kinderund Jugendmedizin, 2015, 12(3): 168-173
- [5] Marom T, Alvarez-Fernandez PE, Jennings K, et al. Acute bacterial sinusitis complicating viral upper respiratory tract infection in young children[J]. Pediatric Infectious Disease Journal, 2014, 33(8): 803-808
- [6] Eccles R, Wilkinson JE. Exposure to cold and acute upper respiratory tract infection[J]. Rhinology, 2015, 53(2): 99
- [7] Oué draogo S, Traoré B, Bi Z A B N, et al. Viral etiology of respiratory tract infections in children at the Pediatric hospital in Ouagadougou (Burkina Faso)[J]. Plos One, 2013, 9(9): e110435
- [8] Ocak T, Erdem A, Duran A, et al. The importance of the mean platelet volume in the diagnosis of supraventricular tachycardia [J]. African Health Sciences, 2013, 13(3): 261-266
- [9] Kim DH, Kang SH, Jeong WS, et al. Serum C-reactive protein (CRP) levels in young adults can be used to discriminate between inflammatory and non-inflammatory diarrhea [J]. Digestive Diseases & Sciences, 2013, 58(2): 504-508
- [10] Belanger KAK, Spear WC, Rolls BA, et al. High serum IgE level in the children with acute respiratory syncytial virus infection is associated with severe disease [J]. Journal of Allergy & Clinical Immunology, 2016, 137(2): AB110
- [11] Sreenivasa B, Kumar GV, Manjunatha B. Study of significance of thrombocytosis in lower respiratory tract infections in children[J]. International Journal of Contemporary Pediatrics, 2015, 2(2): 103
- [12] Martinez-Estevez NS, Alvarez-Guevara AN, Rodriguez-Martinez CE. Effects of zinc supplementation in the prevention of respiratory tract infections and diarrheal disease in colombian children: a 12-month randomised controlled trial [J]. Allergologia Et Immunopathologia, 2016, 44(4): 368
- [13] Cabral C, Lucas P J, Ingram J, et al. "It's safer to ..." parent consulting and clinician antibiotic prescribing decisions for children with respiratory tract infections: An analysis across four qualitative studies[J]. Social Science & Medicine, 2015, 136-137(7700): 156
- [14] Peroşgolubi ĉ i ĉ T, Tekavetrkanjec J. Upper respiratory tract infections[J]. Primary Care, 2015, 17(4): 793
- [15] Savarino L, Granchi D, Ciapetti G, et al. Effects of metal ions on white blood cells of patients with failed total joint arthroplasties[J]. Journal of Biomedical Materials Research Part A, 2015, 47 (4): 543-550
- [16] Tartey S, Takeuchi O. Pathogen recognition and Toll-like receptor targeted therapeutics in innate immune cells[J]. International Reviews of Immunology, 2017, 36(2): 57-73
- [17] Ahmad SM, Larsen SK, Svane IM, et al. Harnessing PD-L1-specific cytotoxic T cells for anti-leukemia immunotherapy to defeat mechanisms of immune escape mediated by the PD-1 pathway [J]. Leukemia, 2014, 28(1): 236-238
- [18] Barinov A, Galgano A, Krenn G, et al. CD4/CD8/Dendritic cell complexes in the spleen: CD8⁺ T cells can directly bind CD4⁺ T cells and modulate their response[J]. Plos One, 2017, 12(7): e0180644
- [19] Zhydkov A, Christcrain M, Thomann R, et al. Utility of procalcitonin, C-reactive protein and white blood cells alone and in combination for the prediction of clinical outcomes in community-acquired pneumonia [J]. Clinical Chemistry & Laboratory Medicine Cclm, 2015, 53(4): 559-566
- [20] He CS, Handzlik M, Fraser WD, et al. Influence of vitamin D status on respiratory infection incidence and immune function during 4 months of winter training in endurance sport athletes [J]. Exercise Immunology Review, 2014, 19(2): 86-101
- [21] Somerville VS, Braakhuis AJ, Hopkins WG. Effect of flavonoids on upper respiratory tract infections and immune function: a systematic review and meta-analysis[J]. Advances in Nutrition, 2016, 7(3): 488
- [22] Eastman A J, Osterholzer J J, Olszewski MA. Role of dendritic cell-pathogen interactions in the immune response to pulmonary cryptococcal infection [J]. Future Microbiology, 2015, 10 (11): 1837-1857
- [23] Shakerley N L, Chandrasekaran A, Trebak M, et al. Francisella tularensis catalase restricts immune function by impairing TRPM2 channel activity [J]. Journal of Biological Chemistry, 2016, 291 (8): 3871
- [24] Chun RF, Liu PT, Modlin RL, et al. Impact of vitamin D on immune function: lessons learned from genome-wide analysis [J]. Frontiers in Physiology, 2014, 5(5): 151
- [25] Wang Z, Wang Y, Xu B, et al. Vitamin D improves immune function in immunosuppressant mice induced by glucocorticoid[J]. Biomedical Reports, 2017, 6(1): 120
- [26] He L J, Zhang H P, Li H J, et al. Effect of Serum Vitamin D Levels on Cellular Immunity and Antiviral Effects in Chronic Hepatitis B Patients[J]. Chinese Journal of Immunology, 2016, 62(10): 1933-1939
- [27] Zerofsky M, Ryder M, Bhatia S, et al. Effects of early vitamin D deficiency rickets on bone and dental health, growth and immunity[J]. Maternal & Child Nutrition, 2016, 12(4): 898
- [28] Authority E F S. Scientific Opinion on the substantiation of a health claim related to vitamin D and contribution to the normal function of the immune system pursuant to Article 14 of Regulation (EC) No 1924/2006[J]. Efsa Journal, 2016, 13(5): 4096-4096
- [29] Safer U, Safer V B, Demir S O, et al. Effects of Bisphosphonates and Calcium plus Vitamin-D Supplements on Cognitive Function in Postmenopausal Osteoporosis [J]. Endocrine Metabolic & Immune Disorders Drug Targets, 2016, 16(1): 56
- [30] Lin R. Crosstalk between Vitamin D Metabolism, VDR Signalling, and Innate Immunity [J]. BioMed Research International, 2016, 2016 (5): 1-5