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医学影像物理

肺超声联合白细胞、降钙素原对儿童获得性肺炎的诊断价值

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【摘要】目的:探讨肺超声联合白细胞(WBC)、降钙素原(PCT)对儿童获得性肺炎的诊断价值。**方法:**选取疑似获得性肺炎患儿153例,根据最终临床确诊结果将其分为肺炎组($n=78$)与非肺炎组($n=75$),对所有患者均行肺超声、WBC、PCT检查,观察比较肺超声联合WBC、PCT检查与单独行肺超声检查诊断儿童获得性肺炎的敏感度、特异性、准确度、阳性预测值、阴性预测值、Kappa值。再根据肺炎组患儿病情严重程度分为重度组($n=36$)与非重度组($n=42$),用ROC曲线分析WBC、PCT对获得性肺炎患儿病情严重程度的诊断价值。**结果:**肺超声联合WBC、PCT检查与单独行肺超声检查诊断儿童获得性肺炎的敏感度分别为96.2%、71.8%,特异性分别为97.3%、69.3%,准确度分别为96.7%、70.6%,阳性预测值分别为97.4%、70.9%,阴性预测值分别为96.1%、82.9%,Kappa值分别为0.935、0.411,差异均具有统计学意义($P<0.05$)。ROC曲线分析结果显示,WBC、PCT及WBC联合PCT对获得性肺炎患儿病情严重程度均具有一定的诊断价值($P<0.05$),且WBC联合PCT的AUC大于WBC、PCT,差异均具有统计学意义($P<0.05$)。**结论:**肺超声联合WBC、PCT可提高获得性肺炎患儿的诊断效能,同时有助于诊断其病情严重程度。

【关键词】获得性肺炎;儿童;肺超声;白细胞;降钙素原

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Diagnostic value of lung ultrasound combined with white blood cells and procalcitonin in pediatric community- and hospital-acquired pneumonia

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Abstract: Objective To explore the value of lung ultrasound combined with white blood cells (WBC) and procalcitonin (PCT) in diagnosing pediatric community- and hospital-acquired pneumonia. **Methods** A total of 153 pediatric patients with suspected community- and hospital-acquired pneumonia were enrolled. According to the final clinical diagnosis results, they were divided into pneumonia group ($n=78$) and non-pneumonia group ($n=75$). All patients underwent lung ultrasound, WBC and PCT examinations. The sensitivity, specificity, accuracy, positive predictive value, negative predictive value and Kappa value of lung ultrasound alone and lung ultrasound combined with WBC and PCT in the diagnosis of acquired pneumonia were compared. According to the severity of pneumonia in pneumonia group, pediatric patients were divided into severe group ($n=36$) and non-severe group ($n=42$); and the diagnostic value of WBC and PCT in the severity of acquired pneumonia was analyzed by ROC curves. **Results** The sensitivity, specificity, accuracy, positive predictive value, negative predictive value and Kappa value of lung ultrasound combined with WBC and PCT in diagnosing acquired pneumonia were significantly higher than those of lung ultrasound alone, with statistical significance (96.2% vs 71.8%, 97.3% vs 69.3%, 96.7% vs 70.6%, 97.4% vs 70.9%, 96.1% vs 82.9%, and 0.935 vs 0.411, respectively; all $P<0.05$). The results of ROC curve analysis showed that WBC, PCT and their combination were of certain diagnostic value for the severity of acquired pneumonia ($P<0.05$), and that the AUC of WBC combined with PCT was greater than that of WBC alone and PCT alone ($P<0.05$). **Conclusion** Lung ultrasound combined with WBC and PCT can improve the diagnostic efficiency of pediatric community- and hospital-acquired pneumonia, and meanwhile it is beneficial to the diagnosis of disease severity.

Keywords: acquired pneumonia; children; lung ultrasound; white blood cell; procalcitonin

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前言

肺炎是由病毒或细菌等病原微生物引起下呼吸道感染的一类临床常见的肺部疾病,获得性肺炎是患者在医院或医院外社区环境感染的肺炎,好发于儿童,已成为导致我国儿童死亡的主要疾病之一,早诊断早治疗是临床防治该病的关键^[1-2]。近年来,肺部超声检查作为一种无创性检查,逐渐成为继胸部X线检查后又一诊断儿童肺炎的主要手段,但其用于诊断部分肺实变较轻的患儿效果欠佳^[3]。白细胞(White Blood Cell, WBC)、降钙素原(Procalcitonin, PCT)均可反映机体细菌感染与炎症反应^[4]。本研究采用肺超声联合 WBC、PCT 对儿童获得性肺炎进行

检查,探讨其诊断价值。

1 材料与方法

1.1 一般资料

将2018年2月~2020年2月郴州市第一人民医院儿童医院收治的疑似获得性肺炎患儿153例作为研究对象,均为6~12岁儿童,根据最终临床确诊结果将其分为肺炎组($n=78$)与非肺炎组($n=75$)。肺炎组患者均符合医院获得性肺炎或社区获得性肺炎的诊断标准^[5-6]。两组基本临床资料见表1。再根据肺炎组患儿病情严重程度^[7]分为重度组($n=36$)与非重度组($n=42$)。本研究经本院医学伦理委员会表决通过。

表1 肺炎组与非肺炎组一般资料比较
Tab.1 Comparison of general information between pneumonia group and non-pneumonia group

项目	肺炎组($n=78$)	非肺炎组($n=75$)	t/χ^2 值	P 值
年龄/岁	7.88±1.43	7.76±1.57	0.495	0.622
性别(男/女)	40/38	39/36	0.008	0.929
上呼吸道感染史(有/无,例)	49/29	45/30	0.128	0.720
合并糖尿病(是/否,例)	6/72	4/71	0.348	0.555
收缩压/mmHg	123.37±22.16	123.36±27.50	0.002	0.998
舒张压/mmHg	78.72±14.57	77.45±17.75	0.485	0.629
心率/次·min ⁻¹	72.68±10.26	70.22±11.38	1.405	0.162

1.2 方法

收集所有患者的临床病例资料,进行回顾性分析。所有患者均行肺超声、WBC、PCT 检查。肺超声:患者取仰卧位,彩色多普勒超声仪(GE, LOGIQ E9)对患者整个胸部进行扫描,将探头呈纵向、垂直或倾斜置于肋间隙,沿着肋间隙进行扫描,诊断获得性肺炎的标准参照相关文献^[8]。WBC、PCT 检查:流式细胞仪(贝克曼库尔特, CytoFLEX)对患者外周血 WBC 计数进行检测,酶联免疫吸附实验检测患者外周血清 PCT 水平,试剂盒均购自北京百奥莱博科技有限公司,操作流程均严格参照相关试剂和仪器说明书,参照相关文献标准^[9-10],以 WBC 计数 $>12\times10^9/L$ 、PCT 水平 $>10\text{ }\mu\text{g/L}$ 视为支持获得性肺炎的诊断。

1.3 观察指标

(1)观察比较肺超声联合 WBC、PCT 检查与单独行肺超声检查诊断儿童获得性肺炎的敏感度、特异性、准确度、阳性预测值、阴性预测值、Kappa 值。(2)记录重度组与非重度组每个患儿外周血 WBC、PCT 水平,分析 WBC、PCT 对获得性肺炎患儿病情严重程度的诊断价值。

1.4 统计学方法

采用 SPSS20.0 软件进行统计分析,计量数据用均数±标准差表示,采用 t 检验;计数数据用率表示,组间比较采用卡方检验。独立影响因素分析采用 Logistic 回归模型。采用 ROC 曲线及 AUC 评价 WBC、PCT 对获得性肺炎患儿病情严重程度的诊断价值。 $P<0.05$ 为差异具有统计学意义。

2 结果

2.1 两种方法诊断的敏感度、特异性、准确率、阳性预测值、阴性预测值、Kappa 值比较

两种方法在各组中的检测结果见表2。肺超声联合 WBC、PCT 检查与单独行肺超声检查诊断儿童获得性肺炎的敏感度分别为 96.2%、71.8%,特异性分别为 97.3%、69.3%,准确度分别为 96.7%、70.6%,阳性预测值分别为 97.4%、70.9%,阴性预测值分别为 96.1%、82.9%,Kappa 值分别为 0.935、0.411,差异均具有统计学意义($P<0.05$)。肺超声联合 WBC、PCT 检查诊断儿童获得性肺炎的敏感度、特异性、准确度、阳性预测值、阴性预测值均大于单独行肺超声检查,差异均具有统计学意义($P<0.05$)。

表2 两种方法在各组中的检测结果(例)

Tab.2 Test results of two methods in each group (cases)

方法	结果	临床确诊结果	
		肺炎组	非肺炎组
肺超声联合 WBC、PCT	阳性	75	2
	阴性	3	73
肺超声	阳性	56	23
	阴性	22	52

2.2 WBC、PCT 及其两者联合诊断获得性肺炎患儿病情严重程度的 ROC 曲线分析

ROC 曲线分析结果显示,WBC、PCT 及其两者联合对获得性肺炎患儿病情严重程度均具有一定诊断价值($P<0.05$),且 WBC 联合 PCT 的 AUC 大于 WBC、PCT,差异均具有统计学意义($P<0.05$)。见表 3。

表3 WBC、PCT 及其两者联合诊断获得性肺炎患儿病情严重程度的 ROC 曲线分析

Tab.3 ROC curve analysis of white blood cell, procalcitonin and their combination in diagnosing the severity of pediatric acquired pneumonia

指标	AUC	95% CI	临界值	敏感度/%	特异度/%
WBC	0.704	0.600~0.795	$18.42\times 10^9/L$	53.1	81.7
PCT	0.763	0.663~0.845	$26.78\text{ }\mu\text{g/L}$	53.1	95.0
WBC 联合 PCT	0.820	0.726~0.893	-	62.5	95.0

正常儿童的外周血 WBC 计数应在 $(5\sim 12)\times 10^9/L$,在机体受到外来病原微生物感染时,WBC 可大量增殖分化,通过增殖分化为粒细胞大量合成分泌细胞炎性因子,通过增殖分化为淋巴细胞大量合成分泌淋巴因子与免疫性抗体,通过增殖分化为吞噬细胞、巨噬细胞发挥吞噬病原微生物的作用,因此 WBC 计数增高可反映儿童肺部炎症感染^[14-15];另一方面,PCT 是一种机体在受到细菌、真菌、寄生虫等感染后合成释放的蛋白质,主要用于反映机体细菌感染,在正常人体内含量极低,几乎可以忽略不计。获得性肺炎患儿多由外源性细菌侵入肺部大量增殖所致,肺部炎症应激反应刺激甲状腺 C 细胞大量合成分泌 PCT,PCT 水平异常升高,从而间接反映肺炎存在^[16]。

本研究 ROC 曲线分析结果显示,WBC、PCT 及 WBC 联合 PCT 对获得性肺炎患儿病情严重程度均具有一定诊断价值,且 WBC 联合 PCT 的 AUC 大于 WBC、PCT,差异均具有统计学意义。探究其机制,可能是 WBC 的增殖分化受机体免疫炎症系统调控,当机体受到的外界感染越严重时,机体免疫炎症反应越剧烈,炎症因子合成分泌越旺盛,WBC 计数水平也越高,因此 WBC 计数水平可在一定程度上反映获得性肺炎患儿病情严重程度^[17]。此外,PCT 作为可

3 讨论

获得性肺炎是小儿最常见的呼吸系统疾病之一,主要是由于感染医院或社区环境细菌、病毒、支原体等病原微生物而引起的一类肺部炎症,主要表现为发热、咳嗽、气促、呼吸困难、肺部湿罗音等,严重者可合并脓胸、脓气胸、肺大疱等,危及患儿生命^[11-12]。肺超声与 WBC、PCT 分别为可反映肺部炎症反应的影像学检查与实验室检查,两者联合应用的相关研究较少报道^[13]。

本研究结果显示肺超声联合 WBC、PCT 检查诊断儿童获得性肺炎的敏感度、特异性、准确度、阳性预测值、阴性预测值、Kappa 值均大于单独行肺超声检查。可能原因:WBC 作为人体血液中一种重要的血细胞,发挥着人体重要的免疫功能,可作为免疫系统的一部分帮助机体抵御外来病原微生物的感染。

反映机体感染性炎症反应的特异性生物学指标,其水平可在机体受到严重感染时在短期内迅速升高,灵敏地反映患者全身炎症反应的严重程度,并与其呈正相关,同时可在机体出现严重休克与多器官功能衰竭时显著升高,因此其浓度水平也可反映获得性肺炎患儿病情严重程度^[18]。另外,WBC、PCT 通过定量的方式将获得性肺炎患儿体内炎症反应程度进行量化,通过与肺部超声的影像学定性检查相结合,能更客观、准确地反映该病患儿的病情严重程度,同时两指标联合应用从不同角度分别反映患儿细菌感染与非细菌感染的严重程度,优势互补,从而提高了诊断效能^[19]。Wang 等^[20]研究表明获得性肺炎患儿的肺部组织的炎症损伤严重程度与其 PCT 升高水平成正相关,其 PCT 高水平者临床预后明显差于 PCT 低水平者。Abers 等^[21]研究表明 PCT 升高水平可反映获得性肺炎患儿机体肺部感染的严重程度,并与其住院死亡率成正比。上述文献报道均与本研究结果相符合。

综上所述,肺超声联合 WBC、PCT 可提高获得性肺炎患儿的诊断效能,同时有助于诊断其病情严重程度。

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