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肺超声评分在预测新生儿肺不张疾病中的临床价值*

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摘要 目的:探讨肺超声评分在预测新生儿肺不张疾病中的临床价值。**方法:**2018年3月到2021年4月选择在本院新生儿重症监护病房(neonatal intensive care unit, NICU)诊治的83例新生儿肺不张疾病作为肺不张组,同期选择在本院出生的无呼吸系统疾病新生儿83例作为对照组,所有新生儿都给予肺超声,记录超声特征并进行肺超声评分,判断肺超声诊断价值与预测新生儿肺不张疾病的效果。**结果:**肺不张组的肺超声评分高于对照组($P<0.05$)。在166例新生儿中,肺超声判断为肺不张82例,肺超声诊断新生儿肺不张疾病的敏感性与特异性分别为100.0%(82/82)和98.8%(83/84)。在166例新生儿中,Spearsman相关性分析显示新生儿肺不张疾病与肺超声评分存在相关性($r=0.633$, $P=0.000$)。受试者工作特征(Receiver operating characteristics, ROC)曲线分析显示肺超声评分预测新生儿肺不张疾病肺炎曲线下面积(Area under the curve, AUC)为0.888(95%CI=1.472-3.572)。新生儿肺不张疾病在肺超声上主要表现为胸膜线增厚并模糊,粗糙不平, A线存在,肺滑动征消失,多发典型B线与多发融合B线。**结论:**肺超声是简便、无放射性损伤、准确的检查方法,肺超声评分能有效预测新生儿肺不张疾病中的发生,也能提高对新生儿肺不张疾病的诊断效果。

关键词:肺超声;肺超声评分;新生儿肺不张;预测价值;敏感性;特异性

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The Clinical Value of Lung Ultrasound Score in Predicting Neonatal Atelectasis Disease*

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ABSTRACT Objective: To explore the clinical values of lung ultrasound score in predicting neonatal atelectasis disease. **Methods:** From March 2018 to April 2021, 83 cases of neonatal atelectasis disease diagnosed and treated in the neonatal intensive care unit (NICU) of this hospital were selected as the atelectasis group, and the other 83 cases of no respiratory system diseases were born in this hospital during the same were selected as the control group. All newborns were given lung ultrasound, the ultrasound characteristics were recorded and the lung ultrasound scores were performed to determine the diagnostic value of lung ultrasound and predicted the effects of predicting neonatal atelectasis disease. **Results:** The lung ultrasound score of the atelectasis group were higher than that of the control group ($P<0.05$). There were 82 cases of were diagnosed as atelectasis by lung ultrasound in the 166 cases. The sensitivity and specificity of lung ultrasound in diagnosing neonatal atelectasis were 100.0% (82/82) and 98.8% (83/84), respectively. Spearsman correlation analysis showed that there were correlation between neonatal atelectasis disease and lung ultrasound score ($r=0.633$, $P=0.000$) in the 166 cases. Receiver operating characteristics (ROC) curve analysis showed that the lung ultrasound score predicted the area under the curve (AUC) of neonatal atelectasis disease pneumonia were 0.888 (95%CI=1.472-3.572). Neonatal atelectasis disease were mainly manifested on lung ultrasound as thickened and blurred pleural lines, rough and uneven, the presence of A-line, the disappearance of lung sliding signs, and multiple typical B-lines and multiple fusion B-lines. **Conclusion:** Lung ultrasound are a simple, no-radiation-damaged and accurate examination method. Lung ultrasound scores can effectively predict the occurrence of neonatal atelectasis disease and improve the diagnostic effect of neonatal atelectasis disease.

Key words: Lung ultrasound; Lung ultrasound score; Neonatal atelectasis; Predictive value; Sensitivity; Specificity

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前言

儿童具有特殊的免疫、解剖与生理特点,导致易患肺部疾病,该类疾病 3 岁以下儿童多发病,甚至也是首位死亡原因^[1]。特别是新生儿^[2]。新生儿肺不张(Neonatal atelectasis, NPA)不是独立的疾病,是新生儿肺脏疾病常见的并发症,常并发于新生儿肺出血(Neonatal pulmonary hemorrhage, PHN)、新生儿呼吸窘迫综合征 (Neonatal respiratory distress syndrome, NRDS)、新生儿肺炎(Neonatal pneumonia, PN)^[3]。新生儿肺不张在病理特征上多表现为肺泡无气体、肺组织萎陷、肺,肺实变为肺泡内气体被非气体物质替代,肺脏缺氧和疾病耐受差,失去正常肺功能,肺代偿能力低下,甚或导致新生儿出现单侧透明肺、机化性肺炎等。新生儿肺不张的病情非常凶险,病程进展比较好,是新生儿期死亡的重要原因之一^[4,5]。新生儿肺出血的具体发病机制与病因还无明确,可能为多个因素的共同作用所产生,其中以缺氧、感染、早产儿、低体重儿、低体温报道最为多见^[6,7]。由于新生儿肺不张的病程较快,患儿临床表现不具特殊性,常有并发症,为此对于诊断的要求比较高^[8]。随着医学影像技术广泛发展,新生儿肺不张的检出率明显提高,致残率与死亡率都有了明显降低,但是也需要加强早期诊断。由于肺脏超声检查具有操作简便、准确性、无辐射、便于动态观察等优点,可针对肺部疾病临床复杂的征象,快速发现肺部病变症状,尤其适合在新

生儿重症监护病房(neonatal intensive care unit, NICU)内开展^[9,10]。有研究显示肺脏超声在诊断急性呼吸窘迫综合征、气胸、感染性肺炎、急性肺损伤都具有很好的优势,可评估肺部的通气情况和,从而对肺部病变程度及性质作出判断^[11,12]。肺超声评分(lung ultrasound score, LUS) 为当前超声评定的半定量方法,在评估肺部疾病的严重程度、掌握患儿病情进展方面有重要意义^[13,14]。本文具体探讨了肺超声评分在预测新生儿肺不张疾病中的临床价值,以促进肺超声评分的应用。现总结报道如下。

1 资料与方法

1.1 研究对象

2018 年 3 月到 2021 年 4 月选择在本院 NICU 诊治的 83 例新生儿肺不张疾病作为肺不张组,纳入标准:单胎;有新生儿肺不张症状、体征,符合《实用新生儿学》对新生儿肺不张的诊断标准;有新生儿肺不张均为出生后 7 d 内收入 NICU;患儿家长知情同意本研究;本研究伦理委员会批准了此次研究;临床资料与影像学资料完整。排除标准:先天性心脏病、肺大泡、肺囊腺瘤等先天畸形患儿;先天性感染患儿;神经系统疾病患儿;对本研究治疗药物过敏者。另选择同期在本院出生的无呼吸系统疾病新生儿 83 例作为对照组。

两组新生儿一般资料对比差异无统计学意义($P>0.05$)。见表 1。

表 1 一般资料
Table 1 General Information

Groups	n	Fatal age (week)	Day Age (d)	Body Weight (g)	Sex (male / female)	Delivery method (natural birth / cesarean section)
Pulmonary tension group	83	38.22± 2.49	4.53± 0.04	3104.29± 189.29	43/40	53/30
Control group	83	38.98± 3.11	4.39± 0.11	3103.87± 100.11	42/41	52/31

1.2 超声检查

所有新生儿都给予肺超声检查,使用 Philips CX50 型便携式多普勒超声诊断仪,探头频率 5-10 MHz。患儿处于安静状态,取仰卧位、侧卧位等,通过横向和纵向对肺脏的各个区域进行扫查。发现肺部病变患儿后,以腋前线、腋后线为界,对双肺部前下、侧上、前上、测下、后下、后上、6 个区域 12 个肺野进行重点扫描。

1.3 肺超声评分

肺超声特征:A 线:由胸膜-肺界面声阻抗的差异产生多重反射形成,位于胸膜线下方,与胸膜线平行、彼此等距的线状高回声。B 线:是超声波遇到肺泡气-液界面产生的混响伪像,起源于胸膜线,与胸膜线垂直、放射状线样高回声。对新生儿肺脏 12 区进行相加评分,总分 0-36 分,评分越高,病情越严重。0 分:正常通气量,显示 A 线,可出现零星 B 线;1 分:中度肺通气减少,包括以下情况:肺间质综合征、局部的肺水肿(横切面扫查时融合 B 线、出现胸膜下实变;2 分:重度肺通气减少:肺泡水肿;3 分:肺实变。

所得的图像都通过医院网络传到后处理系统,影像资料均

经 2 名高级职称医师共同分析阅片,当 2 名医师意见不一致时,通过讨论达成一致意见,意见不一致时邀请第 3 名高级职称医师进行最终判定。

1.4 统计方法

数据通过 SPSS17.00 (IBM 公司) 进行分析,计量资料以($\bar{x} \pm s$)表示,组间比较采用两独立样本 t 检验;计数资料以率(%)表示,组间比较采用卡方 χ^2 检验。相关性分析采用 Spearmen 相关性分析,明确诊断的敏感性与特异性,采用 ROC 曲线评价预测价值, $P<0.05$ 表示差异有统计学意义。

2 结果

2.1 肺超声特征对比

肺不张组:胸膜线增厚并模糊,粗糙不平,A 线存在,肺滑动征消失,多发典型 B 线 26 例,多发融合 B 线 32 例。对照组:每个肺野内无 B 线或 <3 条 B 线,至少 3 条以上清晰、平行分布 A 线,胸膜线呈线性强回声且光滑清晰。

2.2 肺超声评分对比

肺不张组的肺超声评分高于对照组($P<0.05$)。见表 2。

表 2 两组肺超声评分对比(分,均数± 标准差)

Table 2 Comparison of lung ultrasound scores in the two groups (score, average ± standard difference)

Groups	n	Pulmonary ultrasound score
Pulmonary tentension group	83	19.38± 1.48
Control group	83	4.34± 0.22
t		24.184
P		0.000

2.3 诊断价值

在 166 例新生儿中,肺超声判断为肺不张 82 例,肺超声诊

断新生儿肺不张疾病的敏感性与特异性分别为 100.0 %(82/82) 和 98.8 %(83/84)。见表 3。

表 3 肺超声诊断新生儿肺不张疾病的敏感性与特异性(n)

Table 3 Sensitivity and specificity of pulmonary ultrasound diagnosis (n)

Pulmonary ultrasound	Final Diagnosis		Total
	Neonatal lung tension disease	Non-neonatal pulmonary tension disease	
Neonatal lung tension disease	82	0	82
Non-neonatal pulmonary tension disease	1	83	84
Total	83	83	166

2.4 相关性分析

在 166 例新生儿中,Spearsman 相关性分析显示新生儿肺不张疾病与肺超声评分存在相关性($r=0.633$, $P=0.000$)。

2.5 影响因素分析

在 166 例新生儿中,ROC 曲线分析显示肺超声评分预测新生儿肺不张疾病肺炎 AUC 为 0.888(95 %CI=1.472-3.572)。

3 讨论

新生儿肺不张疾病是新生儿时期主要的危重疾病及死亡原因之一,发病率约占活产婴 0.05 %,尸检的 5 %左右^[15,16]。新生儿肺不张疾病有两个发病高峰期,其中生后第 1 天由于严重的缺氧引起,比如新生儿窒息、新生儿肺透明膜病等。第二个发生高峰发生在生后第 6-7 d,多由于严重感染、硬肿症等引起^[17]。该病多表现为急性起病,可表现为进行性加重的呼吸困难,伴有发绀、吸气性三凹征、呼吸窘迫、呼气性呻吟等^[18,19]。胸部 X 线对新生儿肺不张疾病主要显示为双肺透亮度减低,甚或出现 "白肺" 样改变,可见支气管充气征,内见均匀分布的颗粒状、网状阴影。不过总体来说,新生儿肺不张疾病早期的临床表现不一,临床表现缺乏特异性,一旦确诊往往为时已晚,死亡率极高^[20]。新生儿生理特点为体厚薄,胸片肺野小,无需使用滤线器,纹理显示清晰及呼吸运动无法自主控制,对于诊断的要求更高^[21]。并且肺不张疾病患儿多在 NICU 进行诊治,常因病情危重及治疗措施限制需要床旁检查。传统的诊断方法具有一定的放射性风险,细微病灶易漏诊^[22]。肺超声在操作上具有更好的简便性,可从身体周围向身体中心扫描检查,不受电离辐射影响,可对可疑病区进行反复扫描,从而提高诊断效果^[23,24]。本研究显示新生儿肺不张疾病在肺超声上主要表现为胸膜线增厚并模糊,粗糙不平, A 线存在,肺滑动征消失,多发典型 B 线与多发融合 B 线。而当前高频超声的分辨率、清晰度、对比度都比较高,更能清楚地显示细微结构,从而有利于提高影像质量,与上述研究结果一致。

新生儿肺不张疾病多发生于早产儿,约占早产儿死亡原因的 50.0 %左右^[25]。影像学检查可对新生儿肺不张疾病进行诊断,并进一步评估患儿治疗预后,是该疾病临床诊治的重要指导依据^[26]。X 线检查的敏感性和特异性较低,胸部 CT 存在一定的高辐射性,也很难对新生儿肺不张疾病作出快速的诊断,而肺超声具有快速、便携、无放射性等特点,已被用作危重患儿决策的重要辅助手段^[27,28]。有研究显示,目前肺超声已被应用至各种肺部疾病临床确诊方面,且准确性较好^[29]。本研究显示肺不张组的肺超声评分高于对照组($P<0.05$);在 166 例新生儿中,肺超声判断为肺不张 82 例,肺超声诊断新生儿肺不张疾病的敏感性与特异性分别为 100.0 %(82/82)和 98.8 %(83/84),结合 Ma H 等^[30]研究分析:肺超声评分为一种超声量化指标,依据肺部分区域数量及超声影像学分值来计算,可对肺部病变程度进行判断,肺超声评分越高,提示肺部疾病越严重;另外, Hirsch FW 等^[31]研究显示:新生儿肺超声评分与氧合指数有密切相关性,可反映新生儿肺通气面积变化,是临床评估肺炎病情的定量指标,可以间接反映病情严重程度,与本研究结果一致。

本研究在显示 166 例新生儿中,Spearsman 相关性分析显示新生儿肺不张疾病与肺超声评分存在相关性($P<0.001$);肺超声评分预测新生儿肺不张疾病肺炎曲线下面积为 0.888,表明其在新生儿肺不张疾病中预测效果较好,结合相关研究分析,肺超声评分为临床提供了量化肺水含量的指标,因此对各区评分标准描述更为细致、清楚,能客观评价肺部病变^[32]。另外,新生儿肺不张疾病的肺脏超声影像学改变早于 X 线和病原学检查,因此还可评估患儿早期肺部状况^[33,34]。本研究也存在一定的不足,肺超声检查依赖检查者的操作手法和经验,并且肺超声评分存在一定的主观性,同时本研究的样本量比较少,将在后续研究中进行探讨。

总之,肺超声是简便、无放射性损伤、准确的检查方法,肺超声评分能有效预测新生儿肺不张疾病中的发生,也能提高对新生儿肺不张疾病的诊断效果,因此为新生儿肺不张疾病的早

期诊断提供了准确且有效的评估方法。

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