

# ROX 指数预测流感相关肺炎患者气管插管的有效性分析

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**摘要:**目的 探讨 ROX 指数预测流感相关肺炎患者气管插管的有效性。方法 选取 2018 年 12 月 1 日-2020 年 2 月 15 日苏州大学附属第一医院经鼻高流量氧疗治疗的流感相关肺炎患者 47 例作为研究对象,根据患者是否进行气管插管,将其分为未插管组 30 例和插管组 17 例。比较两组一般资料,并采用多因素 Logistic 回归分析气管插管的独立显著预测因子;采用受试者工作曲线(ROC)确定最佳的气管插管预测截断值。结果 单因素分析显示,插管组与未插管组在 BMI、甲型流感、淋巴细胞计数、白细胞计数、血小板计数、降钙素原、高血压史、糖尿病史、心率、 $PO_2$  比较,差异无统计学意义( $P>0.05$ );两组性别、年龄、APACHE II 评分、CRP、ROX 指数比较,差异有统计学意义( $P<0.05$ )。多因素 Logistic 回归分析显示,ROX 指数是气管插管独立保护因素 [ $\beta=-0.470$ , AOR(95%CI):0.630(0.400~0.980),  $P=0.041$ ]。ROC 曲线分析显示,ROX 指数预测的曲线下面积为 0.871(95%CI:0.765~0.976),最佳截断值为 5.04,灵敏度为 90.02%,特异度为 70.62%。结论 ROX 指数对预测流感相关肺炎患者经鼻高流量氧疗中气管插管的准确性较高,有助于临床对该疾病的诊断。

**关键词:**流感相关肺炎;ROX 指数;经鼻高流量氧疗

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## Effect of ROX Index in Predicting Tracheal Intubation in Patients with Influenza-related Pneumonia

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**Abstract:** **Objective** To investigate the effect of ROX index in predicting tracheal intubation in patients with influenza-associated pneumonia. **Methods** A total of 47 patients with influenza-associated pneumonia treated by nasal high flow oxygen therapy in the First Affiliated Hospital of Suzhou University from December 1, 2018 to February 15, 2020 were selected as the research objects. According to whether the patients were subjected to tracheal intubation, they were divided into the non-intubation group ( $n=30$ ) and the intubation group ( $n=17$ ). The general data were compared, and the independent predictors of tracheal intubation were analyzed by multivariate Logistic regression. The optimal cut-off value of tracheal intubation was determined by receiver operating curve (ROC). **Results** Univariate analysis showed that there was no significant difference in BMI, influenza A, lymphocyte count, white blood cell count, platelet count, procalcitonin, hypertension history, diabetes history, heart rate and  $PO_2$  between the intubation group and the non-intubation group ( $P>0.05$ ); there were significant differences in gender, age, APACHE II score, CRP and ROX index between the two groups ( $P<0.05$ ). Multivariate logistic regression analysis showed that ROX index was an independent protective factor for tracheal intubation [ $\beta=-0.470$ , AOR(95%CI): 0.630 (0.400~0.980),  $P=0.041$ ]. ROC curve analysis showed that the area under the curve predicted by the ROX index was 0.871 (95%CI: 0.765~0.976), the optimal truncation value was 5.04, the sensitivity was 90.02%, and the specificity was 70.62%. **Conclusion** ROX index has high accuracy in predicting tracheal intubation in patients with influenza-associated pneumonia undergoing nasal high flow oxygen therapy, which is helpful for clinical diagnosis of the disease.

**Key words:** Influenza-related pneumonia; ROX index; High flow nasal cannula therapy

季节性流感(seasonal influenza)是每年由流感病毒引起的人类急性呼吸道感染,具有高度传染性、传播迅速、发病率和死亡率高的特点<sup>[1,2]</sup>。在我国,季节性流感流行每年导致 8.8 万人死亡,占全年呼吸道死亡的 8.2%,并且大多数死亡发生在 60 岁及以上的成年人中<sup>[3,4]</sup>。流感病毒感染在呼吸系统主要表现为原发性病毒性肺炎、病毒性细菌性肺炎和继发性细菌性肺炎<sup>[5,6]</sup>。流感相关肺炎患者常常表现为不同程度的急性低氧性呼吸衰竭,呼吸支持是流感相关肺炎的治疗核心之一,但该治疗需尽量避免延迟插管。ROX 指数是经皮氧饱和度(percutaneous oxygen saturation,  $SpO_2$ )/吸氧浓度(fraction of inspiratory oxygen,  $FiO_2$ )与呼吸频率的比值,可帮助识别

低插管风险和高插管风险的呼吸衰竭患者<sup>[7-9]</sup>。本研究主要探讨 ROX 指数预测流感相关肺炎患者气管插管的有效性,现报道如下。

### 1 资料与方法

1.1 一般资料 选取 2018 年 12 月 1 日-2020 年 2 月 15 日苏州大学附属第一医院收治的流感相关肺炎患者 47 例作为研究对象,其中男 24 例,女 23 例;年龄 41~68 岁,平均年龄( $51.85\pm 16.74$ )岁。纳入标准:①有流感相关症状及 CT 明确有新发渗出表现;②经鼻/咽拭子 PCR 确诊甲型或乙型流感病毒感染;③ $PaO_2/FiO_2$  比值 $<300$ ,需经鼻高流量氧疗(high flow nasal cannula therapy, HFNC)无创通气治疗的患者。排除标准:①住院治疗时间少于 24 h;②入住 ICU 前已行气管插管;③年龄 $<18$  岁;④由于患者原因放弃治疗。本研究已取得苏州大学附属第一医院伦理委员会审核(批号 2021 第 228 号),患者及其家属知情同意并签署知情同意书。

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1.2 方法 收集所有患者年龄、性别、APACHE II 评分、体重指数(BMI)、流感病毒类型,入 ICU 时淋巴细胞计数、白细胞计数、血小板计数、C 反应蛋白(C-reactive protein,CRP)、降钙素原、血肌酐值、血气中氧分压(partial pressure of oxygen,PO<sub>2</sub>)指标。记录入 ICU 后半小时内最差呼吸频率、SpO<sub>2</sub>、FiO<sub>2</sub>,并以此计算得出 ROX 指数。根据患者是否进行气管插管,将其分为未插管组 30 例和插管组 17 例。

1.3 统计学方法 采用 STATA 16.0 数据包进行统计学分析。计数资料以[n(%)]表示,采用  $\chi^2$  检验,计量资料以( $\bar{x} \pm s$ )表示,采用独立样本 *t* 检验;采用多因

素 Logistic 回归分析气管插管的独立显著预测因子;采用受试者操作曲线(ROC)确定最佳的气管插管预测截断值。以  $P < 0.05$  表示差异有统计学意义。

## 2 结果

2.1 单因素分析 插管组与未插管组 BMI、甲型流感、淋巴细胞计数、白细胞计数、血小板计数、降钙素原、高血压史、糖尿病史、心率、PO<sub>2</sub> 比较,差异无统计学意义( $P > 0.05$ );两组性别、年龄、APACHE II 评分、CRP、ROX 指数比较,差异有统计学意义( $P < 0.05$ ),见表 1。

表 1 插管组和未插管组临床指标比较[n(%),  $\bar{x} \pm s$ ]

项目	未插管组( <i>n</i> =30)	插管组( <i>n</i> =17)	统计值	<i>P</i>
男性	19(63.33)	5(29.41)	$\chi^2=4.997$	0.025
年龄(岁)	47.65±14.42	59.45±18.44	<i>t</i> =2.274	0.031
BMI(kg/m <sup>2</sup> )	25.74±2.91	26.01±5.25	<i>t</i> =0.196	0.847
APACHE II 评分(分)	7.25±2.33	14.33±3.45	<i>t</i> =7.542	0.001
甲型流感	21(70.00)	14(82.35)	$\chi^2=0.342$	0.558
淋巴细胞计数(×10 <sup>9</sup> /L)	0.82±0.41	0.64±0.51	<i>t</i> =1.937	0.063
白细胞计数(×10 <sup>9</sup> /L)	8.35±3.94	7.32±3.40	<i>t</i> =0.941	0.353
血小板计数(×10 <sup>9</sup> /L)	172.86±74.35	140.34±73.38	<i>t</i> =1.453	0.156
降钙素原(ng/ml)	2.94±6.48	3.15±6.75	<i>t</i> =0.104	0.918
CRP(mg/L)	108.75±78.91	189.34±121.82	<i>t</i> =2.452	0.022
高血压史	10(33.33)	9(52.94)	$\chi^2=1.732$	0.188
糖尿病史	5(16.67)	2(11.76)	$\chi^2=0.001$	0.978
心率(次/min)	97.31±17.65	106.92±23.41	<i>t</i> =1.472	0.153
PO <sub>2</sub> (mmHg)	69.65±28.26	66.25±32.52	<i>t</i> =0.361	0.721
ROX 指数	9.18±3.65	4.56±2.31	<i>t</i> =5.307	0.001

2.2 多因素分析 多因素 Logistic 回归分析显示,ROX 指数是气管插管独立保护因素[ $\beta=-0.470$ ,AOR(95%CI):0.630(0.400~0.980), $P=0.041$ ].

2.3 ROX 指数预测效能分析 ROC 曲线分析显示,ROX 指数预测的曲线下面积为 0.871 (95%CI:0.765~0.976),最佳截断值为 5.04,灵敏度为 90.02%,特异度为 70.62%。

## 3 讨论

HFNC 是通过无需密封的鼻塞导管直接将一定氧浓度的空氧混合高流量气体输送给患者的一种氧疗方式,这种气体具有高流量、精确氧浓度以及加温湿化的特点。有研究显示<sup>[10-13]</sup>,HFNC 可降低流感相关肺炎患者患者死亡率及住院天数。但 HFNC 治疗失败会延迟插管并增加死亡率,其中有 30%~40%的患者后续需要再次插管<sup>[14,15]</sup>。

研究表明<sup>[16-18]</sup>,在 HFNC 开始的 1~2 h 内应密切观察,如果出现呼吸频率>35 次/min、SpO<sub>2</sub>≤88%、

ROX 指数<2.85、胸腹部矛盾运动或使用辅助呼吸肌等,应及时进行呼吸支持升级。因此,早期预测 HFNC 治疗结果可避免延迟插管,其是提高患者存活率的关键。ROX 指数可在床边通过无创方式快速获取的数据,并且已被证实可用于预测多种原因导致的呼吸衰竭患者预后<sup>[19,20]</sup>。本研究结果显示,插管组与未插管组 BMI、甲型流感、淋巴细胞计数、白细胞计数、血小板计数、降钙素原、高血压史、糖尿病史、心率、PO<sub>2</sub> 比较,差异无统计学意义( $P > 0.05$ );两组性别、年龄、APACHE II 评分、CRP、ROX 指数比较,差异有统计学意义( $P < 0.05$ );在调整了潜在的混杂变量后,多因素 Logistic 回归分析显示,ROX 指数是气管插管独立保护因素[ $\beta=-0.470$ ,AOR(95%CI):0.630(0.400~0.980), $P=0.041$ ],提示入 ICU 时 ROX 指数是一个能预测流感相关肺炎患者无创通气成功的指标。既往研究证实<sup>[21]</sup>,HFNC 患者 ROX 指数大于或等于 4.88 表明其插管风险较低。本研究中 ROC

曲线分析显示,ROX 指数预测的曲线下面积为 0.871 (95% CI: 0.765~0.976), 最佳截断值为 5.04, 灵敏度为 90.02%, 特异度为 70.62%, ROX 指数最佳分界点略高于既往研究<sup>[22]</sup>, 但差别极小, 且本研究对象明确为流感病毒相关肺炎引起呼吸衰竭患者, 而 Hill NS 等<sup>[22]</sup>研究中未区分肺炎患者的病原学种类。因此, 本研究中 ROX 指数具有较高的灵敏度和特异度, 能够帮助 ICU 医生识别新入院需要插管的流感相关肺炎患者。但本研究为回顾性单中心研究, 样本量较小, 缺乏无创通气后动态 ROX 指数变化的数据, 今后需多中心前瞻性研究进一步验证。

综上所述, ROX 指数对预测流感相关肺炎患者无创通气中气管插管的准确性较高, 有助于临床对该疾病的诊断。

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