·临床研究·

老年慢性阻塞性肺疾病急性加重期患者住院期间发生Ⅱ型呼吸衰竭的危险因素及预后

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【摘 要】 目的 探讨老年慢性阻塞性肺疾病急性加重期(AECOPD)患者住院期间发生Ⅱ型呼吸衰竭的危险因素及预后。**方法** 选择海安市人民医院2021年2月至2024年1月收治的344例老年AECOPD患者为研究对象,根据是否并发Ⅱ型呼吸衰竭,将其分为呼吸衰竭组(n=113)与对照组(n=231),比较两组患者临床特征及治疗结局,并在出院时采用圣乔治医院呼吸问题调查问卷(SGRQ)调查呼吸衰竭组存活者及对照组患者生活质量情况。采用SPSS 22.0统计软件进行数据分析,根据数据类型,分别采用t检验或χ^2检验进行组间比较。采用二元logistic回归模型分析影响老年AECOPD患者并发Ⅱ型呼吸衰竭的相关因素。绘制受试者工作特征(ROC)曲线分析急性生理与慢性健康状况Ⅱ(APACHEⅡ)评分及改良呼吸困难量表(DECAF)评分在预测呼吸衰竭患者院内死亡中的价值。**结果** 呼吸衰竭组113例患者中,96例治疗后好转出院,17例(15.04%)院内死亡。呼吸衰竭组存活者出院时SGRQ问卷中各维度得分及量表总得分均高于对照组,差异均有统计学意义(P<0.05)。二元logistic回归分析提示,过去1年内急性加重次数>3次(OR=1.508,95%CI 1.228~1.853)、入院时第一秒用力呼气容积占正常预计值的百分比(FEV1%pred)<45(OR=1.902,95%CI 1.463~2.474)及入院时白蛋白(ALB)<35 g/L(OR=1.322,95%CI 1.084~1.611)是老年AECOPD患者并发Ⅱ型呼吸衰竭的危险因素。ROC曲线分析结果显示,患者入院时改良DECAF评分[曲线下面积(AUC)=0.847,95% CI 0.720~0.973]及APACHEⅡ评分(AUC=0.770,95% CI 0.655~0.885)在预测呼吸衰竭患者院内死亡中均具有良好的价值,其中改良DECAF评分的应用价值高于APACHEⅡ评分。**结论** 具有过去1年内急性加重次数>3次、入院时FEV1%pred<45及入院时ALB<35 g/L特征的老年AECOPD患者更易并发Ⅱ型呼吸衰竭,经系统治疗后Ⅱ型呼吸衰竭患者院内病死率仍然较高,改良DECAF评分在预测患者院内死亡中具有一定价值。Ⅱ型呼吸衰竭存活者出院时生活质量低于单纯AECOPD患者。

【关键词】 老年人;慢性阻塞性肺疾病;Ⅱ型呼吸衰竭;无创机械通气;预后;生活质量
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Risk factors and prognosis of type Ⅱ respiratory failure in elderly patients with acute exacerbation of chronic obstructive pulmonary disease during hospitalization

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【Abstract】 Objective To explore the risk factors and prognosis of type Ⅱ respiratory failure in elderly patients with acute exacerbation of chronic obstructive pulmonary disease (AECOPD) during hospitalization. **Methods** A total of 344 elderly AECOPD patients admitted to Hai'an People's Hospital from February 2021 to January 2024 were enrolled. According to the complication of type Ⅱ respiratory failure, they were divided into a respiratory failure group (n=113) and a control group (n=231). Clinical characteristics and treatment outcomes were compared between the two groups. At discharge, St. George's hospital respiratory questionnaire (SGRQ) was used to investigate the quality of life of survivors in the respiratory failure group and the control group. SPSS 22.0 was used for data analysis, and t test or *Chi*-square test was performed for between-group comparison according to the data type. The factors affecting elderly AECOPD with type Ⅱ respiratory failure were analyzed by binary logistic regression model. Receiver operating characteristic (ROC) curves were plotted to analyze the acute physiology and chronic health evaluation Ⅱ (APACHE Ⅱ) score and the modified dyspnea, eosinopenia, consolidation, acidemia and atrial fibrillation (DECAF) scores in predicting in-hospital death in patients with respiratory failure. **Results** Among the 113 patients in the respiratory failure group, 96 were discharged after treatment, and 17 (15.04%) died in the hospital. At discharge, SGRQ domain scores and total scores of survivors in the respiratory failure group were higher than those in the control group, with statistically significant difference (P<0.05). Binary logistic regression analysis showed that >3 acute exacerbations in the past year (OR=1.508, 95%CI 1.228-1.853), forced expiratory volume in the first second as a

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percentage of normal predicted value (FEV1%pred) at admission < 45 (*OR* = 1.902, 95%*CI* 1.463-2.474), and albumin (ALB) < 35 g/L at admission (*OR* = 1.322, 95%*CI* 1.084-1.611) were risk factors for type Ⅱ respiratory failure in elderly AECOPD patients. ROC analysis found that the modified DECAF score [area under the curve (AUC) = 0.847, 95%*CI* 0.720-0.973] and APACHE Ⅱ score (AUC = 0.770, 95%*CI* 0.655-0.885) at admission had good value in predicting in-hospital death in patients with respiratory failure, with the modified DECAF score outperforming the APACHE Ⅱ score. **Conclusion** Elderly AECOPD patients with >3 acute exacerbations in the past year, FEV1%pred at admission <45, and ALB at admission <35 g/L are more likely to be complicated with type Ⅱ respiratory failure. Despite systemic treatment, the in-hospital death rate of type Ⅱ respiratory failure remains high. The modified DECAF score is valuable in predicting in-hospital death. The quality of life of survivors of type Ⅱ respiratory failure at discharge is lower than that of patients with AECOPD alone.

【Key words】 aged; chronic obstructive pulmonary disease; type Ⅱ respiratory failure; non-invasive mechanical ventilation; prognosis; quality of life

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慢性阻塞性肺疾病急性加重期(acute exacerbations of chronic obstructive pulmonary disease,AECOPD)易引起二氧化碳潴留,导致Ⅱ型呼吸衰竭,进而造成酸中毒、肺功能丧失,AECOPD 并发Ⅱ型呼吸衰竭是导致 COPD 患者病死的重要原因之一[1]。随着我国老龄化社会的到来,慢性阻塞性肺疾病(chronic obstructive pulmonary disease,COPD)患病人群数量不断增大。调查 AECOPD 合并Ⅱ型呼吸衰竭患者的临床表现在有效识别Ⅱ型呼吸衰竭高危人群、尽早采取相关治疗干预中具有重要意义,而准确预测并发Ⅱ型呼吸衰竭者的预后状况,在调整干预方案中具有指导性意义[2,3]。本研究对老年 AECOPD 并发Ⅱ型呼吸衰竭患者的临床特征、预后及出院时生活质量进行调查,旨在为临床提供参考。

1 对象与方法

1.1 研究对象

选择海安市人民医院 2021 年 2 月至 2024 年1 月收治的 344 例老年 AECOPD 患者为研究对象。根据患者入院后是否并发Ⅱ型呼吸衰竭,将其分为呼吸衰竭组(n = 113)与对照组(n = 231)。Ⅱ型呼吸衰竭诊断标准[4]:动脉血氧分压(arterial partial pressure of oxygen,PaO_2)<60 mmHg(1 mmHg = 0.133 kPa),伴二氧化碳分压(arterial carbon dioxide partial pressure,$PaCO_2$)>50 mmHg。纳入标准:(1)符合《慢性阻塞性肺疾病诊治指南》[4]中 COPD 以及急性加重相关诊断标准;(2)临床资料完整;(3)意识清醒,可在医护人员协助下完成相关调查。排除标准:(1)入院时已合并呼吸衰竭;(2)因自发性气胸、胸外伤等其他病因引发的Ⅱ型呼吸衰竭;(3)合并恶性肿瘤;(4)合并免疫系统疾病;(5)合并精神障碍;(6)中途自愿放弃治疗或选择出院/转院。

1.2 方法

1.2.1 治疗方法 对照组患者接受抗感染、解痉平喘、祛痰等 AECOPD 对症支持治疗。呼吸衰竭组患者在此基础上同时给予无创机械通气治疗。采用德国万曼医疗器械有限公司生产的无创呼吸机,呼吸机模式:S/T,采用口鼻面罩通气治疗,初始参数:吸气压力 8~10 cmH_2O(1 cmH_2O = 0.098 kPa),呼吸压力 4 cmH_2O,呼吸频率 12~16 次/min,氧流量 8~10 L/min,根据患者耐受程度适当调整上述参数,每次通气治疗时间 6 h,间歇15~30 min,若无创呼吸机治疗无效可考虑有创呼吸机治疗。

1.2.2 资料收集 (1)一般人口学资料:年龄、性别、体质量指数(body mass index,BMI)、COPD 病程、慢性阻塞性肺疾病全球创议(global initiative for chronic obstructive lung disease,GOLD)肺功能分级、既往 1 年内 COPD 急性加重次数、吸烟史。(2)实验室指标:收集患者入院时实验室检查指标,包括酸碱度(potential of hydrogen,pH)、PaO_2、$PaCO_2$、1s 用力呼气容积占用力肺活量百分比(forced expiratory volume in first second/forced vital capacity,FEV1/FVC)、第一秒用力呼气容积占正常预计值的百分比(forced expiratory volume in first second as a percentage of normal predicted value,FEV1%pred)、血红蛋白(hemoglobin,Hb)、白细胞(white blood cell,WBC)计数、中性粒细胞百分比(neutrophil percentage,NE%)、中性粒细胞与淋巴细胞比值(neutrophil-to-lymphocyte ratio,NLR)、C 反应蛋白(C-reactive protein,CRP)、白蛋白(albumin,ALB)、尿酸、血小板(platelet,PLT)计数、红细胞比容(hematocrit,HCT)。(3)合并症:糖尿病、高血压、肾功能不全、心脏疾病、低钾血症、脑卒中、院内感染等。(4)入院时急性生理与慢性健康状况Ⅱ(acute physiology and chronic health evaluation Ⅱ,APACHE Ⅱ)评分[5]及改良呼吸困难量表(dyspnoea, eosinopenia, consolidation, acidaemia and atrial fibrillation, DECAF)评分[6]。

1.2.3 生活质量调查 采用圣乔治医院呼吸问题调查问卷(St. George's hospital respiratory questionaire,SGRQ)[7]调查患者生活质量,该量表包括呼吸症状、活动情况及疾病影响三个维度,共 50 个条目,得分范围 0~100 分,得分越高,表示疾病对生活质

量的影响越大。

1.3 统计学处理

采用SPSS 22.0统计软件进行数据处理。计量资料以均数±标准差($\bar{x}\pm s$)表示,组间比较采用t检验。计数资料以例数(百分率)表示,组间比较采用χ^2检验。采用二元logistic回归模型分析影响老年AECOPD患者并发Ⅱ型呼吸衰竭的危险因素。绘制受试者工作特征(receiver operating characteristic, ROC)曲线,分析改良DECAF评分与APACHEⅡ评分在预测老年AECOPD合并Ⅱ型呼吸衰竭患者院内死亡中的价值。$P<0.05$为差异有统计学意义。

2 结 果

2.1 呼吸衰竭组与对照组临床资料

344例老年AECOPD患者中有113例并发Ⅱ型呼吸衰竭,Ⅱ型呼吸衰竭发生率为32.85%。呼吸衰竭组中>79岁者占比以及入院时NLR、$PaCO_2$、CPR、HCT水平均高于对照组,COPD病程长于对照组,GOLD分级以及过去1年内急性加重次数高于对照组;入院时PaO_2、FEV1% pred、FEV1/FVC、PLT、ALB及尿酸水平均低于对照组,差异均有统计学意义($P<0.05$;表1)。

表1 呼吸衰竭组与对照组临床资料比较

Table 1 Comparison of clinical data between respiratory failure group and control group

Item	Respiratory failure group($n=113$)	Control group($n=231$)	t/χ^2	P value
Age[n(%)]			7.557	0.006
60-79 years	70(61.95)	176(76.19)		
>79 years	43(38.05)	55(23.81)		
Gender[n(%)]			1.465	0.226
Male	90(79.65)	196(84.85)		
Female	23(20.35)	35(15.15)		
BMI[n(%)]			0.815	0.665
<18.5 kg/m^2	8(7.08)	13(5.63)		
18.5-23.9 kg/m^2	77(68.14)	168(72.73)		
≥23.9 kg/m^2	28(24.78)	50(21.64)		
COPD course[n(%)]			13.963	<0.001
<5 years	34(30.09)	93(40.26)		
5-10 years	34(30.09)	90(38.96)		
≥10 years	45(39.82)	48(20.78)		
GOLD grading[n(%)]			7.923	0.005
Ⅰ-Ⅱ	33(29.20)	104(45.02)		
Ⅲ-Ⅳ	80(70.80)	127(54.98)		
Acute exacerbation frequency in the past year[n(%)]			6.413	0.041
0-1 time	37(32.74)	105(45.46)		
2-3 times	30(26.55)	60(25.97)		
>3 times	46(40.91)	66(28.57)		
Smoking[n(%)]	75(66.37)	158(68.40)	0.143	0.706
Hypertension[n(%)]	46(40.71)	90(38.96)	0.097	0.756
Diabetes mellitus[n(%)]	25(22.12)	53(22.94)	0.029	0.865
Renal insufficiency[n(%)]	3(2.65)	9(3.90)	0.347	0.556
Heart disease[n(%)]	15(13.27)	25(10.82)	0.444	0.505
Hypokalemia[n(%)]	2(1.77)	2(0.87)	0.540	0.463
Stroke[n(%)]	8(7.80)	9(3.90)	1.637	0.201
In-hospital infection[n(%)]	2(1.77)	7(3.03)	0.473	0.492
Glucocorticoid therapy[n(%)]	80(70.80)	169(73.16)	0.212	0.645
Hb(g/L, $\bar{x}\pm s$)	132.15±16.36	133.26±17.45	0.565	0.572
NLR($\bar{x}\pm s$)	4.96±0.89	3.27±0.74	18.582	<0.001
pH($\bar{x}\pm s$)	7.41±0.08	7.42±0.06	1.296	0.196
PaO_2(mmHg, $\bar{x}\pm s$)	58.41±6.78	74.36±7.31	19.457	<0.001
$PaCO_2$(mmHg, $\bar{x}\pm s$)	56.36±5.78	42.39±5.35	22.148	<0.001
FEV1%pred($\bar{x}\pm s$)	39.46±4.39	53.47±6.61	20.427	<0.001
FEV1/FVC(%, $\bar{x}\pm s$)	43.15±5.36	60.34±5.74	26.652	<0.001
CPR(mg/L, $\bar{x}\pm s$)	15.34±2.98	9.47±2.26	20.303	<0.001
PLT($\times10^9$/L, $\bar{x}\pm s$)	161.15±31.15	181.36±25.79	6.365	<0.001
HCT(%, $\bar{x}\pm s$)	43.66±6.03	40.36±5.79	4.897	<0.001
WBC($\times10^9$/L, $\bar{x}\pm s$)	6.46±1.05	6.48±1.11	0.160	0.873
ALB(g/L, $\bar{x}\pm s$)	34.15±5.07	39.46±4.98	9.233	<0.001
Uric acid (μmol/L, $\bar{x}\pm s$)	275.46±32.68	322.07±40.38	10.676	<0.001

BMI: body mass index; COPD: chronic obstructive pulmonary disease; GOLD: global initiative for chronic obstructive lung disease; Hb: hemoglobin; NLR: neutrophil-to-lymphocyte ratio; pH: potential of hydrogen; PaO_2: arterial partial pressure of oxygen; $PaCO_2$: arterial carbon dioxide partial pressure; FEV1: forced expiratory volume in first second; FVC: forced vital capacity; CRP: C-reactive protein; PLT: platelet; HCT: hematocrit; WBC: white blood cell; ALB: albumin. 1 mmHg=0.133 kPa.

2.2 老年 AECOPD 患者并发Ⅱ型呼吸衰竭的二元 logistic 回归分析

将老年 AECOPD 患者是否并发Ⅱ型呼吸衰竭作为因变量，表 1 中有统计学意义的指标作为自变量（入院时 NLR、PaO_2、$PaCO_2$等计量资料的分界值为 ROC 曲线下最大约登指数对应值），行二元 logistic 回归分析，结果提示，过去 1 年内急性加重次数＞3 次、入院时 FEV1% pred＜45 及 ALB＜35 g/L 是并发Ⅱ型呼吸衰竭的危险因素（P<0.05；表 2）。

2.3 改良 DECAF 及 APACHEⅡ评分在预测呼吸衰竭患者预后中的价值

呼吸衰竭组 113 例患者中，96 例治疗后好转出院，17 例院内死亡，死亡率为 15.04%。呼吸衰竭组中死亡患者入院时改良 DECAF 评分及 APCHEⅡ评分均高于存活患者[（3.63±0.65）和（1.69±0.57）分；（21.15±3.15）和（16.35±2.43）分]，差异均有统计学意义（t=12.663，7.164；P<0.001）。ROC 曲线分析结果显示，当患者入院时改良 DECAF 临界值取 3 分时，预测患者预后的 AUC=0.847（95%*CI* 0.720～0.973，P<0.001），灵敏度为 0.706，特异度为 0.937；APACHEⅡ评分临界值取 19 分时，预测患者预后的 AUC=0.770（95%*CI* 0.655～0.885，P<0.001），灵敏度为 0.588，特异度为 0.823。两个指标在预测患者预后中均具有良好的价值，其中改良 DECAF 评分的应用价值高于 APACHEⅡ评分（图 1）。

2.4 呼吸衰竭组存活者及对照组患者出院时生活质量情况比较

呼吸衰竭组 96 例患者出院时 SGRQ 问卷中各维度得分及量表总得分均高于对照组，差异有统计学意义（P<0.05；表 3）。

3 讨 论

呼吸衰竭是导致 COPD 患者病死的常见原因，AECOPD 将给患者气道带来不可逆转的损伤，加上二氧化碳潴留，AECOPD 极易引起Ⅱ型呼吸衰竭[8,9]。本研究 344 例患者住院期间共 113 例（32.85%）并发Ⅱ型呼吸衰竭，一旦并发Ⅱ型呼吸衰竭，患者后期死亡风险将大幅度增加，因此有效识别易发生Ⅱ型呼吸衰竭的高危患者，尽早采取相关预防治疗措施在临床中具有重要意义[10]。

表 2 老年 AECOPD 患者并发Ⅱ型呼吸衰竭危险因素的二元 logistic 回归分析

Table 2 Binary logistic regression analysis of risk factors of elderly AECOPD with type Ⅱ respiratory failure

Factor	β	*SE*	*Wald* χ^2	*OR*	95%*CI*	*P* value
Age>79 years	0.389	0.211	3.399	1.476	0.976-2.231	0.066
COPD course						
<5 years	-	-	-	1	-	-
5-10 years	0.487	0.254	3.676	1.627	0.989-2.677	0.056
≥10 years	0.615	0.339	3.291	1.850	0.952-3.595	0.070
GOLD grade Ⅲ-Ⅳ	0.786	0.446	3.106	2.195	0.916-5.260	0.079
Acute exacerbation frequency in the past year						
0-1 time	-	-	-	1	-	-
2-3 times	0.346	0.184	3.536	1.413	0.985-2.027	0.061
>3 times	0.411	0.105	15.322	1.508	1.228-1.853	<0.001
NLR	0.579	0.298	3.775	1.784	0.995-3.200	0.053
PaO_2>65 mmHg	-0.389	0.211	3.399	0.678	0.448-1.025	0.066
$PaCO_2$>50 mmHg	0.689	0.365	3.563	1.992	0.974-4.073	0.060
FEV1%pred<45	0.643	0.134	23.026	1.902	1.463-2.474	<0.001
FEV1/FVC>50%	-0.466	0.246	3.588	0.628	0.387-1.016	0.059
CPR>12 mg/L	0.773	0.431	3.217	2.166	0.931-5.042	0.074
PLT>170 $\times10^9$/L	-0.579	0.325	3.174	0.560	0.296-1.060	0.076
HCT>41.5%	0.743	0.416	3.190	2.102	0.930-4.751	0.075
ALB<35 g/L	0.279	0.101	7.631	1.322	1.084-1.611	0.005
Uric acid>300 μmol/L	-0.463	0.284	2.658	0.629	0.361-1.098	0.104

AECOPD: acute exacerbations of chronic obstructive pulmonary disease; COPD: chronic obstructive pulmonary disease; GOLD: global initiative for chronic obstructive lung disease; NLR: neutrophil-to-lymphocyte ratio; PaO_2: arterial partial pressure of oxygen; $PaCO_2$: arterial carbon dioxide partial pressure; FEV1: forced expiratory volume in first second; FVC: forced vital capacity; CRP: C-reactive protein; PLT: platelet; HCT: hematocrit; ALB: albumin. -: no datum. 1 mmHg=0.133 kPa.

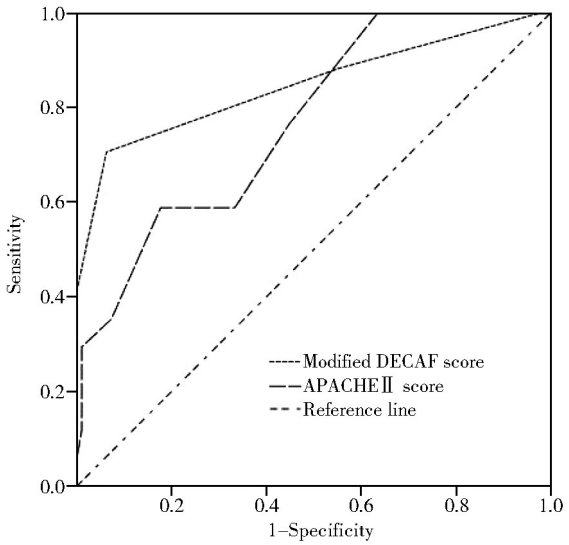


图1 改良DECAF及APACHEⅡ评分在预测呼吸衰竭患者预后中的ROC曲线

Figure 1 ROC curves of modified DECAF score and APACHEⅡ score on predicting prognosis of patients with respiratory failure

DECAF: the dyspnoea, eosinopenia, consolidation, acidaemia and atrial fibrillation score; APACHEⅡ: acute physiology and chronic health evaluationⅡ; ROC: receiver operating characteristic.

表3 呼吸衰竭组存活者及对照组患者出院时生活质量情况比较

Table 3 Comparison of quality of life between respiratory failure survivor group and control group at discharge

(points, $\bar{x}\pm s$)

Group	n	Symptom score	Impact score	Activity score	Total score
Respiratory failure survivor	96	48.74±6.15	38.46±6.11	53.54±9.48	140.74±27.89
Control	231	34.15±5.79	26.89±5.39	40.36±8.79	101.40±20.33
t		20.373	16.984	12.064	14.209
P value		<0.001	<0.001	<0.001	<0.001

本研究结果显示,呼吸衰竭组患者年龄更大、COPD病程更长、GOLD分级靠后、过去1年内急性加重次数多,此外,两组患者NLR、PaO_2、$PaCO_2$、FEV1%pred、FEV1/FVC、CPR等也有显著差异。二元logistic回归分析发现,过去1年内急性加重次数>3次、FEV1%pred<45及ALB<35 g/L是并发Ⅱ型呼吸衰竭的危险因素,分析原因如下。(1)过去1年内急性加重次数:COPD急性加重次数频繁将严重损害患者肺功能,形成恶性循环,增加Ⅱ型呼吸衰竭发生风险[11]。(2)FEV1%pred:FEV1%pred水平是评价患者气流受限的重要指标,FEV1%pred水平下降提示气流受限严重,易引起低氧血症及高碳酸血症,增加Ⅱ型呼吸衰竭发生风险[12]。(3)ALB:ALB是反映机体营养状况的指标,其水平降低提示AECOPD期间存在持续炎症反应或病情加重[13]。此外,ALB水平<35 g/L被定义为低蛋白血症,患者合并低蛋白血症提示其体内肌肉蛋白及收缩蛋白被过度分解,易导致呼吸肌萎缩,诱导呼吸肌疲劳及Ⅱ型呼吸衰竭的发生[14]。

本研究中,所有并发Ⅱ型呼吸衰竭的老年AECOPD患者均接受无创或有创通气治疗,治疗后有15.04%的患者院内死亡。分析发现,呼吸衰竭组中死亡者患者入院时改良DECAF评分及APCHEⅡ评分均高于存活者,绘制ROC曲线发现,患者入院时改良DECAF及APACHEⅡ评分在预测患者预后中均具有良好的价值,其中改良DECAF评分的应用价值高于APACHEⅡ评分。提示入院时改良DECAF评分可用于预测老年AECOPD并发呼吸衰竭患者的预后,应给予改良DECAF评分>3分者额外关注,包括严格监测患者病情,及时更改治疗方案等。

此外,本研究中呼吸衰竭组存活者出院时生活质量较对照组更低,提示尽管经过系统治疗,Ⅱ型呼吸衰竭患者病情好转,满足出院条件,但其生活质量水平依旧较低。这与Ⅱ型呼吸衰竭患者治疗难度大、病情更为严重,身心受损程度更高相关[15]。提示临床还应注重Ⅱ型呼吸衰竭患者出院后生活质量情况。

综上,具有过去1年内急性加重次数>3次、入院时FEV1%pred<45及入院时ALB<35 g/L等特征的老年AECOPD更易并发Ⅱ型呼吸衰竭,经系统治疗后,Ⅱ型呼吸衰竭院内病死率依旧较高。改良DECAF评分在预测患者院内死亡中具有一定价值,且Ⅱ型呼吸衰竭存活者出院时生活质量依旧低于未并发呼吸衰竭的AECOPD患者。

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