

qSOFA 评分对 ICU 感染患者预后的评估价值： 来自真实世界的 17 年观察性研究

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【摘要】目的 探讨快速序贯器官衰竭评分(qSOFA)对重症医学科(ICU)感染患者预后的预测价值。**方法** 回顾性分析 2000 年 8 月 1 日至 2017 年 12 月 31 日解放军第四〇一医院 ICU 感染患者的临床资料。收集患者的性别、年龄、基础疾病等;就诊 24 h 内生命体征和实验室检验结果的最差值,计算 qSOFA、序贯器官衰竭评分(SOFA)、急性生理学与慢性健康状况评分 II (APACHE II);记录 ICU 预后。用受试者工作特征曲线(ROC)分析 3 种评分系统预测感染患者预后的效能。**结果** 排除数据资料不完善、癌症及免疫抑制患者,最终纳入 1059 例成人感染患者,其中男性 679 例,女性 380 例;平均年龄(72.57±16.06)岁;ICU 死亡 374 例,病死率为 35.32%。ROC 曲线分析显示,APACHE II、SOFA、qSOFA 评分预测感染患者预后的 ROC 曲线下面积(AUC)分别为 0.713、0.744、0.662。虽然 qSOFA 预测预后的 AUC 明显小于另 2 种评分系统(均 $P < 0.05$),但其仍具有一定预测能力。根据约登(Youden)指数确定 qSOFA 评分对患者预后预测的最佳截断值为 2 分,敏感度为 71.65%,特异度为 53.87%,阳性似然比为 1.55,阴性似然比为 0.53,阳性预测值为 0.426,阴性预测值为 0.799,准确性为 59.62%。ICU 感染患者病死率随 qSOFA 评分增高而升高,不同 qSOFA 评分患者间病死率差异有统计学意义($\chi^2 = 84.605, P = 0.000$)。根据 qSOFA 最佳截断值将患者分为两组,qSOFA ≥ 2 分组患者的死亡风险明显高于 qSOFA < 2 分组[优势比(OR) = 2.767, 95% 可信区间(95%CI) = 2.116 ~ 3.617, $P = 0.000$]。**结论** qSOFA、SOFA 和 APACHE II 评分均可预测感染患者的预后;qSOFA 评分因快速获取的优势,可望作为判断 ICU 感染患者预后的快捷而简便工具。

【关键词】 急性生理学与慢性健康状况评分 II; 序贯器官衰竭评分; 快速序贯器官衰竭评分; 感染; 预后

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Evaluation value of the quick sequential organ failure assessment score on prognosis of intensive care unit adult patients with infection: a 17-year observation study from the real world Qin Xiuju, Lin Huiyan, Liu Tingxing, Zhao Lili, Li Hailing

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【Abstract】Objective To investigate the predictive value of quick sequential organ failure assessment (qSOFA) score on the prognosis of adult patients with infection in intensive care unit (ICU). **Methods** A retrospective analysis was conducted on the clinical data of the infected patients in the ICU of the 401st Hospital of the People's Liberation Army from August 1st, 2000 to December 31st, 2017. The clinical data included patients' gender, age, basic diseases, etc.; the worst values of vital signs and laboratory test results within 24 hours of admission were recorded, the scores of the qSOFA, sequential organ failure assessment (SOFA), acute physiology and chronic health evaluation II (APACHE II) were calculated separately; the outcome of ICU was recorded. The predictive values of three scoring systems were evaluated by receiver operating characteristic curve (ROC). **Results** Excluding patients with incomplete clinical data, cancer and immunosuppressive patients, a total number of 1059 patients were enrolled in this study, with 679 males and 380 females, the average age was 72.57 ± 16.06, the ICU mortality was 35.32% (374/1059). The ROC curve analysis showed that the areas under ROC curve (AUC) of APACHE II, SOFA, qSOFA scores to predict the prognosis of infected patients were 0.713, 0.744 and 0.662, respectively. Although the AUC of qSOFA in predicting prognosis was significantly lower than that of other two scoring systems (both $P < 0.05$), but it still had some predictive ability. According to the Youden index, the best cut-off point for qSOFA was 2 to evaluate the prognosis of the infection, and the sensitivity was 71.65%, the specificity was 53.87%, the positive likelihood ratio was 1.55, the negative likelihood ratio was 0.53, the positive predictive value was 0.426, the negative predictive value was 0.799, and the accuracy was 59.62%. The mortality of the infected patients was increased with qSOFA score, and the mortality difference among patients with different

qSOFA scores was statistically significant ($\chi^2 = 84.605, P = 0.000$). The patients were divided into two groups according to the cut-off value of qSOFA, and the mortality in qSOFA score ≥ 2 group was higher than that in qSOFA score < 2 group [odds ratio (OR) = 2.767, 95% confidence interval (95%CI) = 2.116–3.617, $P = 0.000$]. **Conclusions** qSOFA, SOFA and APACHE II scores have the capability of predicting the outcome for the infected patients. qSOFA score is expected to be a quick and simple tool to judge the prognosis of ICU infection patients because of its advantages of quick acquisition.

【Key words】 Acute physiology and chronic health evaluation II; Sequential organ failure assessment; Quick sequential organ failure assessment; Infection; Prognosis

Fund program: Logistical Science and Technology Project (JN13W018)

2016年2月,美国危重病医学会(SCCM)与欧洲重症监护学会(ESICM)提出脓毒症最新定义为,严重感染引起的机体免疫反应失调进而导致致命性的器官功能障碍,并且在Sepsis-3中首次提出能够预测脓毒症预后的3个有效指标,即:收缩压 ≤ 100 mmHg(1 mmHg=0.133 kPa)、呼吸频率 ≥ 22 次/min及意识状态改变,并将这3个指标组合定义为快速序贯器官衰竭评分(qSOFA)^[1]。qSOFA可迅速鉴别那些可能长时间在重症医学科(ICU)住院或住院期间有死亡风险的可疑严重感染患者,目前已有相关研究验证了qSOFA在急诊感染患者预后中的预测价值,但qSOFA是否适用于ICU感染患者预后的判定,目前尚未得到广泛报道。本研究通过回顾分析本院ICU连续17年收治的感染患者的相关资料,旨在评估qSOFA对患者预后的预测价值,并与急性生理学与慢性健康状况评分II(APACHE II)和序贯器官衰竭评分(SOFA)的预测价值进行对比,进一步探讨qSOFA对ICU感染患者预后的预测效能。

1 对象与方法

1.1 研究对象:选择2000年8月1日至2017年12月31日解放军第四〇一医院ICU收治的感染性疾病患者为研究对象。

1.1.1 入选标准:年龄 ≥ 18 岁;收住ICU的全部感染患者。

1.1.2 排除标准:癌症患者;近3个月内有糖皮质激素或其他免疫抑制剂使用史;人类免疫缺陷病毒抗体阳性;临床资料不完整者。

1.2 伦理学:本研究符合医学伦理学标准,经本院伦理委员会批准同意(审批号:2018-08),相关的治疗及指标检测均获得过患者及家属的知情同意。

1.3 研究方法:收集患者的基本临床资料,包括性别、年龄、基础疾病;记录就诊24 h内生命体征和实验室检验结果的最差值,计算qSOFA、SOFA、APACHE II评分;记录ICU预后。

1.4 统计学方法:使用SPSS 21.0软件进行统计分析。对于符合正态分布的定量资料以均数 \pm 标准

差($\bar{x} \pm s$)表示,采用 t 检验;非正态分布的定量资料以中位数(四分位数间距)[$M(Q_R)$]表示,采用非参数检验;计数资料采用 χ^2 检验。绘制各评分的受试者工作特征曲线(ROC),用ROC曲线下面积(AUC)评估其对ICU病死率的预测价值,使用Medcalc软件,采用 Z 检验比较不同评分方法的AUC,根据约登(Youden)指数确定3种评分方法的最佳截断值及其相应的敏感度、特异度、预测值、似然比及准确性等。检验水准 $\alpha = 0.05$ 。

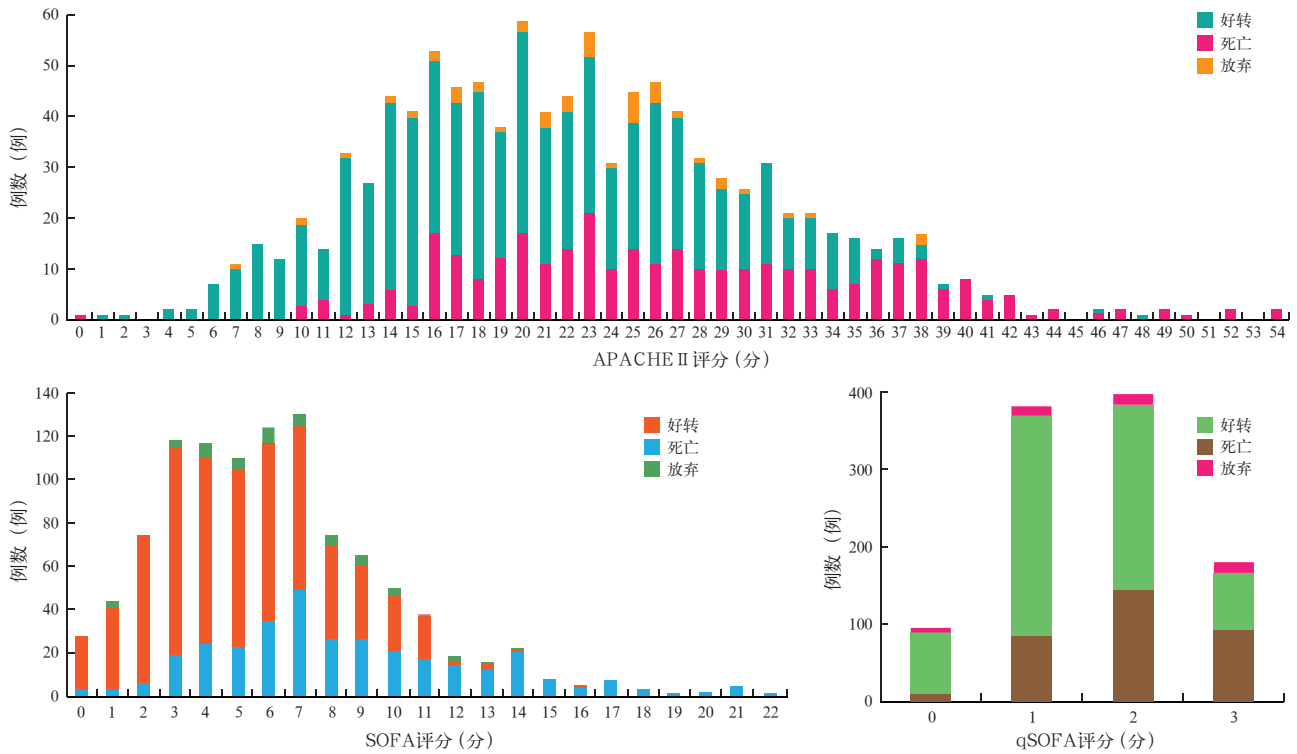
2 结果

2.1 患者一般资料:入选1132例患者,排除22例数据资料不完善、30例癌症患者、21例使用免疫抑制患者,最终纳入研究1059例。1059例患者中男性679例,女性380例;年龄20~97岁,平均(72.57 \pm 16.06)岁;肺部感染801例(75.64%),腹腔感染175例(16.52%),泌尿系感染37例(3.49%),颅内感染24例(2.27%),其他部位感染(包括心肌炎、皮肤软组织感染等)22例(2.08%);ICU内死亡374例,病死率为35.32%。

2.2 3种评分的分布情况(图1):1059例感染患者APACHE II评分0~54分,平均(22.51 \pm 8.66)分;SOFA评分0~22分,平均(6.22 \pm 3.72)分;qSOFA评分0~3分,平均(1.63 \pm 0.88)分。

2.3 3种评分对感染患者预后的预测价值(图2;表1):ROC曲线分析显示,SOFA预测预后的AUC最大,其次为APACHE II、qSOFA评分;虽然3种评分的AUC均 > 0.6 ,但qSOFA预测预后的AUC明显低于SOFA和APACHE II评分(均 $P < 0.05$),而SOFA与APACHE II评分的AUC差异无统计学意义。表明3种评分均能预测ICU感染患者的预后,但qSOFA的预测能力低于SOFA和APACHE II评分,而SOFA与APACHE II评分的预测能力相当。

2.4 qSOFA评分对预后的评估作用(表2):ICU感染患者病死率随qSOFA评分增高而升高,不同qSOFA评分患者间病死率差异有统计学意义($\chi^2 = 84.605, P = 0.000$)。



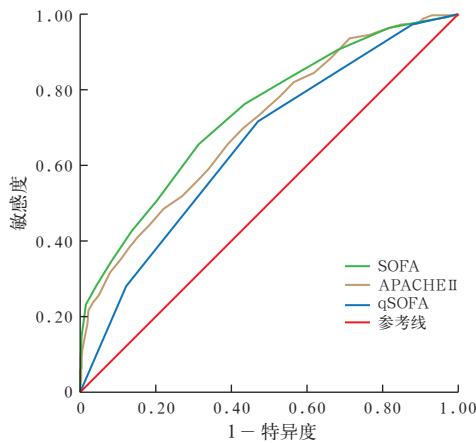
注: ICU 为重症医学科, APACHE II 为急性生理学及慢性健康状况评分 II, SOFA 为序贯器官衰竭评分, qSOFA 为快速序贯器官衰竭评分

图 1 ICU 感染患者 3 种评分的分布情况

表 1 3 种评分系统对 ICU 感染患者预后的预测价值

评分系统	AUC	95%CI	P 值	最佳截断值	敏感度 (%)	特异度 (%)	阳性似然比	阴性似然比	阳性预测值	阴性预测值	准确性 (%)
qSOFA	0.662	0.632 ~ 0.691	<0.001	2	71.65	53.87	1.55	0.53	0.426	0.799	59.62
SOFA	0.744 ^a	0.716 ~ 0.771	<0.001	7	65.55	69.78	2.17	0.49	0.509	0.809	68.41
APACHE II	0.713 ^b	0.684 ~ 0.741	<0.001	22	70.12	58.10	1.67	0.51	0.445	0.802	61.99

注: ICU 为重症医学科, qSOFA 为快速序贯器官衰竭评分, SOFA 为序贯器官衰竭评分, APACHE II 为急性生理学及慢性健康状况评分 II, AUC 为受试者工作特征曲线下面积, 95%CI 为 95% 可信区间; 与 qSOFA 比较, ^a $P < 0.01$, ^b $P < 0.05$



注: SOFA 为序贯器官衰竭评分, APACHE II 为急性生理学及慢性健康状况评分 II, qSOFA 为快速序贯器官衰竭评分, ICU 为重症医学科, ROC 曲线为受试者工作特征曲线

图 2 3 种评分系统对 ICU 感染患者预后预测的 ROC 曲线

2.5 qSOFA 评分对感染患者死亡风险评估: 根据 qSOFA 评分预测预后的最佳截断值 2 分将患者分为两组。qSOFA ≥ 2 分组患者的死亡风险明显高于

表 2 不同 qSOFA 评分 ICU 感染患者的病死率分布情况

qSOFA	例数(例)	死亡(例)	好转(例)	病死率(%)
0 分	98	15	83	15.31
1 分	382	96	286	25.13
2 分	398	158	240	39.70
3 分	181	105	76	58.01
合计	1 059	374	685	35.32

注: qSOFA 为快速序贯器官衰竭评分, ICU 为重症医学科; 不同 qSOFA 评分间病死率比较, $\chi^2 = 84.605$, $P = 0.000$

qSOFA < 2 分组 [优势比 (OR) = 2.767, 95% 可信区间 (95%CI) = 2.116 ~ 3.617, $P = 0.000$]。

3 讨论

脓毒症是当前 ICU 面临的棘手难题, 近期一项 Meta 分析提示, 全球每年约有 3 150 万人次发生脓毒症, 1 940 万人次发生严重脓毒症, 每年可导致 530 万人死亡^[2], 且治疗费用较高, 给患者带来了较大的经济负担^[3], 我国重症感染的发生率也高达 8.68%^[4], 即使是存活患者, 生存质量也受到了一定

程度的影响^[5]。如何选择一种理想的评分方法^[6],既能及时发现危重患者给予充分治疗,又能在感染患者中筛选出易发生器官衰竭者,是临床医生尤其是ICU医生迫切需要解决的难题。目前已有多种关于疾病严重程度分级和评估预后的评分系统,如SOFA和APACHE II^[7-10],且二者在ICU内已被广泛应用,但其均需要采集较多参数才能完成评分,较为费时。2016年,ESICM/SCCM基于对临床疑似感染患者的大数据分析,筛选出能够相对准确地预测脓毒症的3个指标,即呼吸频率、格拉斯哥昏迷评分(GCS)、收缩压,并将其命名为qSOFA评分^[1]。自提出以来,SOFA评分因操作简单、迅速易得、可重复性好,很快被临床医师采用。但由于临床应用qSOFA评分的时间较短,其准确性和特异性仍需进一步临床数据证实。

王盛标等^[11]用SOFA、qSOFA、APACHE II评分预测脓毒症患者的预后,其AUC分别为0.700、0.604、0.672;本研究结果显示,SOFA、qSOFA、APACHE II评分预测ICU感染患者预后的AUC分别为0.744、0.662、0.713,表明三者对感染患者预后均存在评估价值。本研究中SOFA、APACHE II评分的预测效能均高于qSOFA评分,且存在统计学差异,考虑可能与SOFA和APACHE II评分包含的参数较qSOFA评分多有关,这与Seymour等^[12]的研究结果一致。

本研究结果显示,随着qSOFA评分的增高,ICU感染患者病死率增加。qSOFA评分预测预后的最佳截断值为2分,此截断值与国内外的研究结果基本吻合^[12-13]。以此截断值将ICU感染患者分为两组,结果显示,qSOFA ≥ 2 分组患者的死亡风险显著高于qSOFA < 2 分组,提示qSOFA评分对疑似感染患者的预后有良好的评估作用。

qSOFA评分参数少,不需要实验室数据,床旁即可获得,便于医生操作,已有多项研究验证过其在急诊感染患者预后中的评估价值^[13-14],但对ICU疑似感染患者,qSOFA的评估效能并不一致^[5, 15-16]。本研究显示,qSOFA评分对此类人群评估的敏感度及特异度均不高,分析原因可能为:①感染患者延迟应用抗菌药物会导致病死率增高^[17],故大多数感染患者在进入ICU前已经在社区医院或急诊应用抗菌药物,这使得qSOFA筛查感染患者的特异性降低。②目前多采用GCS评分对患者意识状态进行评估,但是GCS评分不能体现意识状态的动态变化。

③ICU感染患者的生命体征随时会发生变化,不同时间点的评分对预后预测价值不同^[18]。④ICU患者大部分需要多器官功能支持,例如使用呼吸机或血管活性药物,此状态下的呼吸频率和血压并不能反映病情的变化。

鉴于qSOFA评分的敏感度和特异度不高,有研究者提出应联合SOFA评分对病情严重程度进行评估:若qSOFA > 1 分,应给予高度关注和积极治疗;若qSOFA ≤ 1 分,则应进一步进行SOFA评分,对SOFA亦在1分以下者,建议继续观察^[19]。血乳酸是评估危重患者预后的敏感指标^[20-22],亦有研究者提出qSOFA与乳酸联合检测^[23],但目前尚无定论。

本研究为单中心回顾性观察性研究,由于纳入病例数有限,仍需扩大样本量、增设多中心研究加以证实。本研究时间跨度大,随着近几年危重病的快速发展,感染患者的病死率较前下降^[24],可能影响其最终结果。

综上,qSOFA评分简便、快捷、不需要等待实验室检查结果,便于医师应用,在评估ICU感染患者预后方面具有一定价值,虽然敏感度及特异度不高,但在临床应用时,qSOFA的误差在可接受范围内,并且其优势可以得到充分发挥。但要更加精确而特异地反映ICU感染患者的预后情况,仍需进一步结合临床客观资料。

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本刊常用不需要标注中文的缩略语

心脏停搏 (cardiac arrest, CA)
 院外心脏停搏
 (out-of-hospital cardiac arrest, OHCA)
 院内心脏停搏 (in-hospital cardiac arrest, IHCA)
 心肺复苏 (cardiopulmonary resuscitation, CPR)
 劳力性热射病 (exertional heat stroke, EHS)
 肠内营养 (enteral nutrition, EN)
 肠外营养 (parenteral nutrition, PN)
 机械通气 (mechanical ventilation, MV)
 急性肺损伤 (acute lung injury, ALI)
 急性肾损伤 (acute kidney injury, AKI)
 药代动力学 (pharmacokinetics, PK)
 药效动力学 (pharmacodynamics, PD)
 呼吸机相关性肺损伤
 (ventilator induced lung injury, VILI)
 呼吸机相关性肺炎
 (ventilator-associated pneumonia, VAP)

慢性阻塞性肺疾病 (chronic obstructive pulmonary disease, COPD)
 急性呼吸窘迫综合征 (acute respiratory distress syndrome, ARDS)
 多器官功能障碍综合征 (multiple organ dysfunction syndrome, MODS)
 全身炎症反应综合征 (systemic inflammatory response syndrome, SIRS)
 ICU 获得性肌无力 (intensive care unit acquired weakness, ICUAW)
 腹部提压心肺复苏术 (active abdominal compression-decompression
 cardiopulmonary resuscitation, AACD-CPR)
 自主循环恢复 (return of spontaneous circulation, ROSC)
 体外膜肺氧合 (extra corporeal membrane oxygenation, ECMO)
 目标温度管理 (targeted temperature management, TTM)
 医院信息系统 (hospital information system, HIS)
 实验室信息系统 (laboratory information system, LIS)
 重症监护医学信息数据库 III
 (Medical Information Mart for Intensive Care III, MIMIC-III)
 灾难医学救援信息监测系统 (the surveillance in post
 extreme emergencies and disasters system, SPEED 系统)
 重症加强治疗病房 / 重症医学科 (intensive care unit, ICU)