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脓毒症患者 PtcO₂PtcCO₂ 的监测意义及对预后的评估作用研究 *

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摘要 目的:探讨脓毒症患者无创经皮组织氧分压(tcpO₂)和二氧化碳分压(tcpCO₂)的监测意义及用于患者预后评估的价值。方法:选择 2016 年 1 月至 2018 年 12 月我院接诊的 80 例脓毒症患者进行研究,根据监测方式的不同分为观察组 (n=50) 和对照组 (n=30)。对照组患者采用常规监测动脉血气,观察组患者采用经皮氧分压/二氧化碳分压连续监测,并根据相关数据指导液体复苏,提高氧输送,并追踪患者预后。分析和比较两组的 tcpO₂、tcpCO₂、氧偏移度及急性生理与慢性健康评分 II (APACHE II) 在脓毒症的变化及诊断价值。**结果:**观察组患者 tcpO₂、tcpCO₂、氧偏移度及 APACHE II 均明显高于对照组 ($P<0.05$); 两组死亡组患者 tcpO₂、氧偏移度及 APACHE II 均显著高于存活组、而 tcpCO₂ 低于存活组 ($P<0.05$); logistic 回归分析显示 tcpO₂、tcpCO₂ 均与氧偏移度及 APACHE II 呈显著正相关 ($P<0.05$); tcpO₂ 诊断脓毒症的 AUC 为 0.806, 95%CI 为 0.710~0.902; tcpCO₂ 诊断脓毒症的 AUC 为 0.723, 95%CI 为 0.608~0.839; 氧偏移度诊断脓毒症的 AUC 为 0.970, 95%CI 为 0.938~1.000; APACHE II 诊断脓毒症的 AUC 为 0.932, 95%CI 为 0.879~0.985; 联合检测诊断脓毒症的 AUC 为 0.997, 95%CI 为 0.989~1.000, 联合检测的特异度、准确度分别为 93.74%、95.68%, 显著高于各指标单独检测 ($P<0.05$)。**结论:**经皮氧/二氧化碳分压监测装置早期监测有助于早期评估脓毒症的严重程度与预后。

关键词:脓毒症; 无创经皮组织氧分压; 二氧化碳分压; 预后

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A Study on the Significance of Monitoring PtcO₂PtcCO₂ in Sepsis Patients and the Evaluation of Prognosis*

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ABSTRACT Objective: To study on the significance of monitoring Noninvasive percutaneous oxygen partial pressure (tcpO₂) and carbon dioxide partial pressure (tcpCO₂) in sepsis patients and the evaluation of prognosis. **Methods:** 80 patients with sepsis treated in our hospital from January 2016 to December 2018 were selected for the study, the monitoring methods were divided into observation group (n=50) and control group (n=30). Patients in the control group were routinely monitored for arterial blood gas, while patients in the observation group were continuously monitored for percutaneous oxygen partial pressure/carbon dioxide partial pressure. Fluid resuscitation was guided according to relevant data to improve oxygen delivery, and the prognosis of patients was tracked. Analysis of tcpO₂, tcpCO₂, oxygen migration degree and acute physiology and chronic health evaluation II (APACHE II) change in sepsis and diagnostic value. **Results:** Observation group of patients tcpO₂, tcpCO₂, oxygen migration degree and APACHE II were significantly higher than that of control group ($P<0.05$); Two groups of patients death tcpO₂, oxygen migration and APACHE II group were significantly higher than survival, while tcpCO₂ is lower than the survival group ($P<0.05$); Logistic regression analysis showed that tcpO₂ and tcpCO₂ with oxygen migration and APACHE II has significant positive correlation ($P<0.05$); The AUC of tcpO₂ in the diagnosis of sepsis was 0.806, and the 95%ci was 0.710~0.902. The AUC of tcpCO₂ in the diagnosis of sepsis was 0.723, and the 95%CI was 0.608~0.839. The AUC and 95% ci in the diagnosis of sepsis were 0.970 and 0.938~1.000 respectively. APACHE II diagnosis of sepsis in the AUC is 0.932, 95% CI 0.879 to 0.985; The AUC and 95% of combined detection in the diagnosis of sepsis were 0.997 and 0.989~1.000, respectively. The specificity and accuracy of combined detection were 93.74% and 95.68%, respectively, which were significantly higher than the individual detection of each indicator ($P<0.05$). **Conclusion:** Early detection of percutaneous oxygen/carbon dioxide partial pressure monitoring device is helpful for early assessment of sepsis severity and prognosis, which is worthy of popularization and application.

Key words: Sepsis; Noninvasive percutaneous tissue oxygen partial pressure; Partial pressure of carbon dioxide; The prognosis

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前言

脓毒症是机体对感染反应失调而导致危及生命的器官功能障碍,具有较高的病死率和病残率。重症感染性休克是脓毒症发展最严重的类型,预后差^[1,2]。因此,选择有效指标评估脓毒症患者病情的严重程度十分关键,可早期指导医师进行合理干预。

PtcO₂/PtcCO₂是在加热、湿润局部皮肤的状态下,从皮肤扩散的组织中的氧和二氧化碳,直接反映了组织利用氧和二氧化碳的情况及组织灌注情况和通气状况。研究显示 PtcO₂/PtcCO₂监测可以更早、更敏感地反映脓毒症患者休克时外周组织的缺氧情况,并且和休克复苏时的变化趋势一致^[3,4]。PtcO₂/PtcCO₂可以对脓毒症患者休克早期预警,评估患者充分液体复苏后组织灌注的改善情况^[5,6]。本研究主要探讨脓毒症患者 PtcO₂/PtcCO₂的监测意义及对患者预后评估的参考价值,旨在为其临床应用提供更多的参考依据,现将结果报道如下。

1 资料与方法

1.1 一般资料

选择2016年1月至2018年12月我院接诊的80例脓毒症患者进行研究,研究已获得我院伦理委员会批准实施。观察组中,男27例,女23例,年龄18~63岁,平均年龄(44.98±8.52)岁,肺部感染31例,腹部感染19例;对照组中,男19例,女11例,年龄18~65岁,平均年龄(45.27±7.13),肺部感染21例,腹部感染9例。两组性别($\chi^2=0.668, P=0.414$)、年龄($t=0.101, P=0.920$)等一般资料比较均无显著性差异,具有可比性。

纳入标准:重症脓毒症诊断标准参照《脓毒症的新标准

(Sepsis 3.0):共识而富有争议^[7],符合以下标准中任意一项即可,①出现低氧血症,氧合指数(PaO₂/FiO₂)<300;②收缩压(SBP)<90 mmHg,平均动脉压(MAP)<70 mmHg;③血小板计数<1.0×10¹¹/L;④总胆红素>70 mmol·L⁻¹;⑤急性少尿2 h内的尿量<45 mL;⑥皮肤有花斑出现,毛细血管再充盈时间延长,或出现高乳酸血症;并处于意识障碍、昏迷、嗜睡状态。

排除标准:①患有心、肝、肾、肺、凝血等器官功能障碍;②合并恶性肿瘤;③脑死亡;④严重营养不良;⑤合并艾滋病等免疫缺陷。

1.2 监测方法

观察组患者通过经皮氧分压/二氧化碳分压连续监测,并根据相关数据指导液体复苏,提高氧输送,并追踪患者预后,仪器:TCM4-series,购于RADIOMETER公司;对照组采用常规监测动脉血气及乳酸值,根据相关数据施行液体复苏等综合治疗,追踪预后;采用APACHE II对脓毒症严重程度进行测定。

1.3 统计学分析

以spss18.0软件包处理研究数据,计量资料用均数±标准差($\bar{x} \pm s$)表示,组间比较以t检验,计数资料以率表示,组间比较采用 χ^2 检验。使用受试者工作特征曲线(ROC)分析tcpO₂、tcpCO₂、氧偏移度及APACHE II的诊断效能,以 $P<0.05$ 表示差异具有统计学意义。

2 结果

2.1 两组患者相关指标比较

观察组患者tcpO₂、tcpCO₂、氧偏移度及APACHE II均明显高于对照组($P<0.05$),见表1。

表1 两组患者相关指标比较($\bar{x} \pm s$)

Table 1 Comparison of the related indicators between the two groups($\bar{x} \pm s$)

Groups	n	tcpO ₂ (mmHg)	tcpCO ₂ (mmHg)	Oxygen migration degree (%)	APACHEII
Observation group	50	47.92±12.24	49.03±12.67	0.49±0.11	15.18±3.47
Control group	30	65.86±11.28	40.11±13.31	0.27±0.09	9.16±2.58
t value		6.532	2.992	9.247	8.227
P value		0.000	0.004	0.000	0.000

2.2 两组患者不同预后相关指标比较

两组死亡组患者tcpO₂、氧偏移度及APACHE II均显著高

于存活组,tcpCO₂低于存活组($P<0.05$),见表2。

表2 两组不同预后患者相关指标的比较($\bar{x} \pm s$)

Table 2 Comparison of the related indicators between patient with different prognostic in the two groups($\bar{x} \pm s$)

Indicators	Observation group		t value	P value	Control group		t value	P value
	Death group (n=15)	Survival group (n=35)			Death group (n=12)	Survival group (n=18)		
tcpO ₂ (mmHg)	40.14±9.75	51.25±13.31	2.909	0.006	53.24±10.24	74.27±11.97	4.984	0.000
tcpCO ₂ (mmHg)	40.91±7.56	52.51±18.10	2.383	0.021	33.13±11.43	44.76±14.56	2.326	0.028
Oxygen migration degree (%)	0.68±0.13	0.41±0.10	7.983	0.000	0.34±0.08	0.11±0.09	7.159	0.000
APACHEII	17.23±2.49	14.30±3.89	2.683	0.000	13.15±2.49	6.50±2.64	6.911	0.000

2.3 脓毒症患者 tcpO₂、tcpCO₂ 与氧偏移度及 APACHE II 的相关性分析

logistic 回归分析显示, tcpO₂、tcpCO₂ 均与氧偏移度及 APACHE II 呈显著正相关($P<0.05$), 见表 3。

表 3 脓毒症患者 tcpO₂、tcpCO₂ 与氧偏移度及 APACHE II 的相关性分析
Table 3 Correlation analysis of tcpO₂ and tcpCO₂ with oxygen deviation and APACHE II in sepsis patients

指标	tcpO ₂		tcpCO ₂	
	r 值	P 值	r 值	P 值
氧偏移度	0.762	0.000	0.625	0.000
APACHE II	0.737	0.000	0.713	0.000

2.4 tcpO₂、tcpCO₂、氧偏移度及 APACHE II 诊断脓毒症患者的临床价值分析

tcpO₂ 诊断脓毒症的 AUC 为 0.806, 95% CI 为 0.710~0.902; tcpCO₂ 诊断脓毒症的 AUC 为 0.723, 95% CI 为 0.608~0.839; 氧偏移度诊断脓毒症的 AUC 为 0.970, 95% CI 为 0.938~1.000; APACHE II 诊断脓毒症的 AUC 为 0.932, 95% CI 为 0.879~0.985。联合检测诊断脓毒症的 AUC 为 0.997, 95% CI 为 0.989~1.000, 联合检测的特异度、准确度分别为 93.74%、95.68%, 显著高于各指标单独检测。

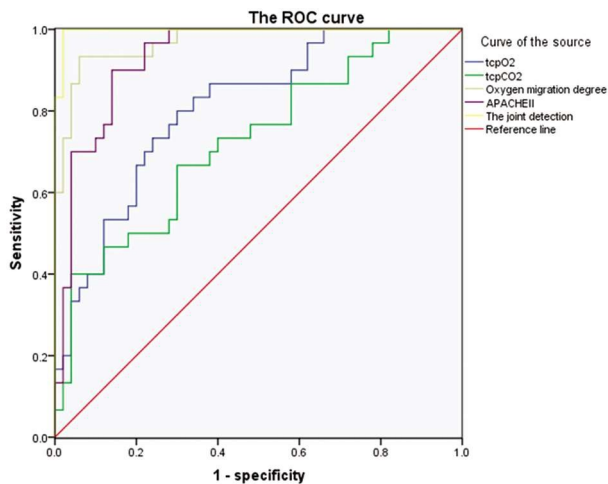


图 1 tcpO₂、tcpCO₂、氧偏移度、APACHE II 及联合检测脓毒症的 ROC 曲线

Fig.1 tcpO₂, tcpCO₂, oxygen migration, APACHE II ROC curves and the joint detection of sepsis

表 4 tcpO₂、tcpCO₂、氧偏移度、APACHE II 及联合检测脓毒症的 ROC 曲线下面积
Table 4 tcpO₂, tcpCO₂, oxygen migration, APACHE II and joint detection area under the ROC curve of sepsis

Test variables	AUC	Standard error	P	95%CI
tcpO ₂	0.806	0.049	0.000	0.710~0.902
tcpCO ₂	0.723	0.059	0.001	0.608~0.839
Oxygen migration degree	0.970	0.016	0.000	0.938~1.000
APACHE II	0.932	0.027	0.000	0.879~0.985
The joint detection	0.997	0.004	0.000	0.989~1.000

测是脓毒症休克的早期预警指标, 同时也是脓毒症液体复苏可靠的终点监测目标, 可作为脓毒症休克微循环预测的可靠指标。分析是因为将 PtcO₂/PtcCO₂ 监测运用到在脓毒症休克患

3 讨论

脓毒症是由感染引起的全身炎症反应综合征, 是有细菌存在或有高度可疑感染灶, 常常发生在有严重疾病的患者中^[8-10]。其发病机制涉及到复杂的全身炎症网络效应、免疫功能障碍、凝血功能异常等多个方面^[11-14]。休克的本质为组织氧供不能维持正常组织代谢, 因此纠正组织缺氧是休克治疗的中心内容。脓毒症休克患者的血流动力学监测在重症医学领域发展日新月异, 从过去的肺动脉漂浮导管, 到如今的乳酸连续监测、CVP 监测, 从减轻患者痛苦到提高人文关怀角度, 总体的趋势是从有创到无创, 从微观到宏观, 但是其效果都不明显, 患者预后较差^[15-18]。研究显示 PtcO₂/PtcCO₂ 的监测已运用于临床中糖尿病末梢早期血管病变等疾病中^[19-22]。PtcO₂/PtcCO₂ 监测是在重症医学领域的大环境下应用而生, 可以为患者提供更准确、持续、早期的血流动力学数据, 再结合现有的血流动力学监测手段, 更好地为脓毒症患者提供准确的氧供与氧耗数据, 从而能指导临床医生为脓毒症患者合适地液体复苏及适当的氧疗, 提高脓毒症患者抢救的成功率^[23,24]。

tcpO₂ 和 tcpCO₂ 主要反映机体的组织灌注以及微循环情况, 是皮肤最早出现的缺氧和缺血的重要器官, 在一定程度上可反映机体的微循环障碍^[25-27]。APACHE II 评分指标是临床上对危重症患者进行测评的重要指标, 可作为预测继发感染的指标^[28-30]。本研究结果显示使用 PtcO₂/PtcCO₂ 监测的患者的 tcpO₂、tcpCO₂、氧偏移度及 APACHE II 均明显高于使用 CVP 监测的患者, 且两组死亡组患者 tcpO₂、氧偏移度及 APACHE II 均显著高于存活组, tcpCO₂ 低于存活组。这说明 PtcO₂/PtcCO₂ 监

者, 通过其连续的氧 / 二氧化碳监测结果, 为循环状况提供早期、精确和快速预警, 有效减少动脉采血次数, 提高样本质量及减少医源性贫血, 实现对微循环的评估, 从而指导脓毒症患者

表 5 tcpO₂、tcpCO₂、氧偏移度、APACHE II 及联合检测脓毒症的诊断效能Table 5 tcpO₂, tcpCO₂, oxygen migration degree, APACHE II and joint detection the diagnosis efficiency of sepsis

Test variables	Sensitivity	Specificity	Accuracy	Youden index
tcpO ₂	82.32	74.59	81.25	1.58
tcpCO ₂	83.18	76.18	77.64	1.62
Oxygen migration degree	81.56	78.33	81.02	1.63
APACHE II	82.39	79.52	83.49	1.57
The joint detection	87.46	93.74	95.68	1.74

的液体复苏,将压力的监测与容量的复苏密切相连,使该监测的解结果不仅仅停留在提示机体的氧供氧需状态,并能快速诊断,提高患者安全性。此外,本研究结果还显示 tcpO₂、tcpCO₂、氧偏移度及 APACHE II 联合检测诊断脓毒症的特异度、准确度显著高于各指标单独检测,显示出联合检测在诊断脓毒症上具有更高的价值。但本次研究样本较少,且未分析治疗前后各项指标的变化,今后仍需扩大样本量,延长实验时间进一步深入研究。

综上所述,经皮氧 / 二氧化碳分压监测装置早期监测有助于早期评估脓毒症的严重程度与预后。

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