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无创正压通气治疗重症社区获得性肺炎临床疗效和预后影响 *

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摘要 目的: 考察无创正压机械通气(noninvasive positive-pressure ventilation, NIPPV)对重症社区获得性肺炎(Severe community acquired Pneumonia, SCAP)的治疗效果和预后的影响。方法: 以2018年7月-2020年2月我院收治的80例SCAP患者为研究对象, 采用随机数字法分为无创组和常规组, 各40例。两组患者均在入院后均接受常规治疗, 无创组在常规治疗的基础上进行NIPPV治疗。详细记录患者治疗前和治疗后1 h、24 h的体温、呼吸、血压、心率、血二氧化碳分压(arterial partial pressure of CO₂, PaCO₂)、氧合指数(PaO₂/FIO₂)、气管插管率、病死率、ICU住院天数, 对患者入院的第1、3、7 d的血清可溶性尿激酶型纤溶酶原激活物受体(soluble urokinase-plasminogen activator receptor, suPAR)、降钙素原(procalcitonin, PCT)及C反应蛋白(C-reactive protein, CRP)的水平进行检测。结果: 治疗后1 h和24 h, 无创组患者呼吸、心率、PaCO₂、PaO₂/FIO₂和PH均显著的改善($P < 0.05$), 显示NIPPV可明显改善患者肺部气体交换, 减慢呼吸频率、提高氧和指数, 降低二氧化碳分压; 第1 d两组患者的PCT、CRP和suPAR的水平无明显差异($P > 0.05$), 相对于第1 d, 两组患者第3 d和第7 d的PCT、CRP和suPAR水平均明显的降低($P < 0.05$); 相对于常规组, 第3 d和第7 d无创组患者的PCT、CRP和suPAR水平有显著的降低($P < 0.05$); 与常规组相比, 无创组患者的插管率、ICU住院天数和死亡率统计学上无显著差异($P > 0.05$), 但均有一定程度上的降低。结论: NIPPV能显著改善SCAP患者的呼气情况, 降低血清PCT、CRP和suPAR水平, 对降低气管插管率、缩短ICU住院天数, 降低患者死亡率有一定的效果。

关键词: 无创正压通气; 重症社区获得性肺炎; PCT; CRP; suPAR

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Clinical Efficacy and Treatment of Non-invasive Positive Pressure Ventilation in the Treatment of Severe Community-acquired Pneumonia Prognostic Impact*

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ABSTRACT Objective: To investigate the effect of noninvasive positive pressure ventilation on the treatment effect and prognosis of severe community-acquired pneumonia. **Methods:** Taking 80 patients with SCAP admitted to our hospital from July 2018 to February 2020 as the research object, they were divided into non-invasive group and routine group by random number method, 40 cases each. Both groups of patients received conventional treatment after admission, and the non-invasive group received NIPPV treatment based on conventional treatment. The patient's body temperature, respiration, blood pressure, heart rate, PaCO₂, PaO₂/FIO₂, endotracheal intubation rate, fatality rate, and ICU hospitalization days were recorded before and after treatment. The serum PCT, CRP and suPAR levels on the first, third and seventh days of the patients' admission were tested. **Results:** 1 h and 24 h after treatment, the patients in the noninvasive group had significant improvement in respiration, heart rate, PaCO₂, PaO₂/FIO₂ and PH ($P < 0.05$). It shows that NIPPV can significantly improve the gas exchange in the lungs of patients, slow down the respiratory rate, increase oxygen and index, and reduce the partial pressure of carbon dioxide. On the first day, there was no significant difference in the levels of PCT, CRP and suPAR between the two groups ($P > 0.05$). Compared with the first day, the PCT, CRP and suPAR levels on the third and seventh days of the two groups of patients were significantly reduced ($P < 0.05$). Compared with the conventional group, the PCT on the third and seventh days of the noninvasive group,

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CRP and suPAR levels were significantly reduced ($P<0.05$). Compared with the conventional group, there was no statistically significant difference in the intubation rate, ICU hospital stay, and mortality in the noninvasive group ($P>0.05$), but they all decreased to a certain extent. **Conclusion:** NIPPV can significantly improve the expiratory condition of SCAP patients, reduce serum PCT, CRP and suPAR levels, have a certain effect on reducing the rate of tracheal intubation, shortening the length of hospital stay in ICU and reducing the mortality of patients.

Key words: Noninvasive positive pressure ventilation; Severe community-acquired pneumonia; PCT; CRP; suPAR

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前言

社区获得性肺炎(Community-acquired pneumonia, CAP)为一种常见的呼吸内科疾病,发病率为每年 2%~12%,这其中有 20%左右的患者需住院治疗,入院患者中有 10%左右的人会进展为重症肺炎(Severe community-acquired pneumonia, SCAP)而进入 ICU 治疗,其死亡率非常高^[1,2]。近年重症 CAP 患者渐增多,以老年人居多,大部分在 65 岁以上,肺功能储备降低,代偿能力减退,营养状况也相对较差,且常伴有慢性心肺基础疾患^[3,4]。SCAP 可引起患者全身免疫力下降和全身炎症反应,肺组织水肿,炎性渗出,肺内分流,部分肺泡塌陷,低氧血症等,如不及时干预会有呼吸窘迫甚至多器官功能衰竭情况发生^[5-9]。在对患者进行临床治疗的过程中也常面临着细菌耐药性增加,患者病情危重,病死率增加等问题。因此在进行有效药物治疗的同时,对患者进行及时的辅助通气治疗,也是控制患者病情发展的有力措施。

无创正压通气(Noninvasive positive pressure ventilation, NIPPV)多用于慢性阻塞性肺病,成功率高,疗效确切,能明显降低气管插管率,从而有效避免有创通气所引起的呼吸机相关性肺炎及其并发症^[10]。相对于有创机械通气而言,NIPPV 对患者创伤小,操作简便,及时有效,也临床应用中也日渐成熟。PCT 是预测 CAP 患者病情的重要指标^[11],CRP 能敏感的反映机体感染情况^[12],suPAR 参与炎症反应^[13]、肿瘤发生^[14]等多种病理生理过程,对提示患者感染程度有一定的价值。

本研究采用 NIPPV 辅助对 SCAP 患者进行治疗,为了更准确客观的评价 SCAP 患者病情,也对 NIPPV 治疗 SCAP 患者的血清 PCT、CRP、suPAR 进行动态变化水平进行检测,有助于对患者病情的发展趋势和预后有更好的了解和掌握。

1 对象与方法

1.1 一般资料

以 2018 年 7 月~2020 年 2 月我院收治的 80 例 SCAP 患者为研究对象,采用随机数字法分为无创组和常规组,各 40 例。无创组男 28 例,女 12 例,年龄 43~71 岁,平均年龄(51.2 ± 5.7)岁,病程 13 ± 9 d;首次血气分析指标:PaCO₂ 55 ± 3 mmHg, PaO₂ 52 ± 12 mmHg, pH 值 7.27 ± 0.04 。常规组男 25 例,女 15 例,年龄 45~72 岁,平均年龄(51.5 ± 0.2)岁,病程 12 ± 7 d,首次血气分析指标:PaCO₂ 53 ± 8 mmHg, PaO₂ 54 ± 11 mmHg, pH 值 7.31 ± 0.06 。两组患者基本信息如性别构成比、年龄、病程等经分析无统计学意义($P>0.05$),具有可比性。患者及家属均充分了解研究内容并签署知情同意书,本研究已获得医院伦

理委员会的准许。

1.2 诊断标准

根据临床指南^[15]重症 CAP 的诊断标准如下,患者需满足主要标准一项或次要标准三项及以上。

主要标准:① 患者需进行机械通气;② 患者有感染性休克,需应用血管升压剂。

次要标准:① 患者呼吸频率 ≥ 30 次/min;② PaO₂/FiO₂ ≤ 250 ;③ 多叶肺病变;④ 意识/定向障碍;⑤ 患有尿毒血症(血尿素氮 ≥ 7.14 mmol/L);⑥ 白细胞减少症(白细胞计数 $\leq 4 \times 10^9/L$);⑦ 血小板减少症(血小板计数 $<100 \times 10^9/L$);⑧ 低体温现象(中心体温 $<36^\circ\text{C}$);⑨ 患有低血压且需要行液体复苏。

1.3 纳入与排除标准

纳入标准:符合 SCAP 诊断标准;无免疫系统疾病,未长期使用免疫抑制剂。

排除标准:合并肺结核、慢性阻塞性肺病、肺占位病变等其他肺部疾病;合并生殖、消化以及泌尿系统等感染疾病;严重心律失常或心脏骤停;近期使用过激素、免疫抑制剂、较强镇静剂患者;近期有外科手术史。

1.4 治疗方法

无创组和常规组患者在入院后均接受常规治疗,如抗感染、化痰止咳、吸氧、抗休克、扩张支气管、维持水电解质平衡和营养支持等治疗。无创组在常规治疗的基础上进行 NIPPV 治疗,首次血气分析检查之后行 NIPPV 治疗。呼吸机(瑞思迈 VPAP III ST-A 型),具体参数为:S/T 模式,呼吸频率 12~20 次/min,初始吸气压(IPAP)为 10 cmH₂O,逐步调整压力至 10~20 cmH₂O,呼气压(EPAP)为 4~6 cmH₂O,维持 SPO₂ 在 90%~95%。每日治疗时间多少根据患者动脉血气分析值而定。

1.5 观察指标

详细记录患者治疗前和治疗后 1 h、24 h 的体温、呼吸、血压、心率、PaCO₂、PaO₂/FIO₂、气管插管率、病死率、ICU 住院天数。

血清 PCT、CRP、suPAR 的检测:在患者入院的第 1、3、7 d,分别采集清晨空腹外周静脉血标本,进行血清 PCT、CRP、suPAR 的测定。PCT 采用半定量固相免疫检测法(所用试剂盒购自 BRAHMS Diag-nostica 公司)CRP 采用免疫比浊法检测(所用试剂盒购自四川迈克公司),suPAR 采用酶联免疫吸附法(所用试剂盒购自上海酶联生物科技),均严格按照说明书进行操作。

1.6 数据处理

以 SPSS 19.0 对数据进行分析,计量资料以 $\bar{x} \pm s$ 表示,使用 t 检验,计数资料采用率(%)表示,使用 χ^2 检验, $P<0.05$ 为具有统计学意义。

2 结果

2.1 治疗前后呼吸血流动力学比较

对无创组和常规组患者治疗前和治疗后 1 h、24 h 的呼吸、血流动力学指标进行检测,结果见表 1,治疗后 1 h 和 24 h,无

创组患者呼吸、心率、 PaCO_2 、 $\text{PaO}_2/\text{FIO}_2$ 和 pH 均显著的改善 ($P<0.05$),显示 NIPPV 可明显改善患者肺部气体交换,减慢呼吸频率、提高氧和指数,降低二氧化碳分压,见表 1。

表 1 治疗前后患者呼吸血流动力学比较

Table 1 Comparison of patients' respiratory hemodynamics before and after treatment

Index	Before treatment		1 h after treatment		24 h after treatment	
	Conventional group	Noninvasive group	Conventional group	Noninvasive group	Conventional group	Noninvasive group
Breath (times / min)	32± 9	33± 8	29± 6	24± 5*	30± 6	25± 4*
Heart rate (beats / min)	115± 24	109± 26	101± 17	89± 11*	103± 16	90± 13*
Systolic blood pressure (mmHg)	137± 25	141± 12	128± 31	131± 28	133± 34	127± 15
PaCO_2 (mmHg)	53± 8	55± 3	41± 3	33± 6*	40± 5	33± 2*
$\text{PaO}_2/\text{FIO}_2$	201± 53	208± 46	262± 35	311± 25*	281± 29	328± 34*
pH	7.31± 0.06	7.29± 0.04	7.32± 0.04	7.41± 0.12*	7.33± 0.06	7.41± 0.08*

Note: Compared with the conventional group, * $P<0.05$.

2.2 治疗前、后 PCT、CRP、suPAR 动态变化

对两组患者治疗第 1 d、第 3 d 和第 7 d 的血清 PCT、CRP 和 suPAR 水平的动态变化进行检测,结果如表 2 所示。第 1 d 两组患者的 PCT、CRP 和 suPAR 的水平无明显差异 ($P>$

0.05);相对于第 1 d,两组患者第 3 d 和第 7 d 的 PCT、CRP 和 suPAR 水平均明显的降低($P<0.05$);相对于常规组,第 3 d 和第 7 d 无创组患者的 PCT、CRP 和 suPAR 水平有显著的降低 ($P<0.05$),见表 2。

表 2 治疗前、治疗 PCT、CRP、suPAR 动态变化

Table 2 Dynamic changes of PCT, CRP and suPAR before treatment

Index	The first day		The third day		The seventh day	
	Conventional group	Noninvasive group	Conventional group	Noninvasive group	Conventional group	Noninvasive group
PCT(ng/mL)	6.93± 1.35	7.19± 2.06	6.21± 1.21*	5.87± 1.75**	5.79± 2.04*	5.25± 1.01**
CRP(mg/L)	89.34± 11.54	87.21± 10.48	86.64± 14.63*	80.38± 13.64**	79.53± 11.43*	72.77± 10.53**
suPAR(ng/mL)	7.35± 0.95	7.23± 1.32	6.74± 0.87*	6.35± 1.05**	6.15± 0.55*	5.56± 0.71**

Note: compared with the first day, * $P<0.05$; compared with the conventional group, ** $P<0.05$.

2.3 两组患者插管率、ICU 住院时间、死亡率比较

对两组患者经治疗后的插管率、ICU 住院时间、死亡率进行比较,结果见表 3,显示与常规组相比,无创组患者的插管

率、ICU 住院天数和死亡率统计学上无显著差异($P>0.05$),但均有一定程度上的降低,见表 3。

表 3 两组患者插管率、ICU 住院时间、死亡率比较

Table 3 Comparison of intubation rate, ICU hospital stay and mortality rate between the two groups

Groups	n	Intubation rate	ICU hospital stay (days)	Mortality
Conventional group	40	27(67.5)	25± 13	23(57.5)
Noninvasive group	40	24(35.0)	20± 8	16(40.0)

3 讨论

近年来,SCAP 发病率呈现日益增多的趋势,高死亡率、高医疗成本^[16]。SCAP 患者多存在肺通气不足和肺换气障碍等肺功能障碍,而且分泌物多阻塞细支气管,从而导致下呼吸道梗阻,极有可能引起急性呼吸衰竭等,进而对心脏等其他重要器官产生不利的影响^[17,18]。虽然临床抗感染治疗手段不断加强,但是 SCAP 患者的发病率与死亡率却未能够得到有效的降低。

NIPPV 由呼吸机提供正压支持,通过鼻面罩将呼吸机与病人相连的方式,从而完成通气的人工通气方式,不经气管插管和气管切开等人工气道方式。常用于急性呼吸衰竭、慢阻肺、心脏术后呼吸衰竭、新生儿呼吸窘迫综合征^[19-22]等疾病。

本研究采用 NIPPV 辅助治疗 SCAP,对无创组和常规组患者治疗前和治疗后 1 h、24 h 的呼吸、血流动力学指标进行检测,结果表明,治疗后 1 h 和 24 h,无创组患者呼吸、心率、 PaCO_2 、 $\text{PaO}_2/\text{FIO}_2$ 和 pH 均显著的改善,显示 NIPPV 可明显改善

患者肺部气体交换,减慢呼吸频率、提高氧和指数,降低二氧化碳分压。SCAP 患者常表现为呼吸肌明显疲劳,使用 NIPPV 可以通过减少患者呼吸做功,显著改善患者呼吸疲劳情况,对其他基础治疗手段有很好的支持作用,也尽量的为病情的缓解赢取时间,并且在使用规范的基础上,对患者无明显的气压伤等副损伤。

SCAP 患者的疾病发生发展过程中,由炎性因子所介导的炎症反应发挥着重要作用,寻找能够有效推断监控 SCAP 发生、发展以及预后的指标,具有重要的临床意义。因此我们观察研究了患者采用 NIPPV 辅助治疗第 1 d、第 3 d 和第 7 d 的血清 PCT、CRP 和 suPAR 水平的动态变化,以此来探讨这三者水平在 SCAP 患者诊断和治疗过程中的作用。结果显示,第 1 d 两组患者的 PCT、CRP 和 suPAR 的水平无明显差异;相对于第 1 d,两组患者第 3 d 和第 7 d 的 PCT、CRP 和 suPAR 水平均明显的降低;相对于常规组,第 3 d 和第 7 d 无创组患者的 PCT、CRP 和 suPAR 水平有显著的降低。

PCT 是一种降钙素前肽物质,自身没有激素活性,属于糖蛋白,正常生理状态下由甲状腺的 C 细胞产生,而在严重的细菌感染状态下细菌毒素能够激活体内的多种细胞,引起患者血 PCT 水平的显著升高,可作为一种提示急性细菌性感染的临床指标,具有高度的特异性和灵敏性,对 CAP 患者病情的评估预测有具有重要的意义^[23-25]。PCT 可由细菌内毒素和炎性细胞因子诱导产生,SCAP 患者体内细菌大量繁殖裂解,使细菌内毒素大量释放,引起患者血清 PCT 水平的显著增加,且 PCT 的血清浓度和炎症的严重程度紧密相关,其水平可随着炎症的控制和病情缓解而恢复正常水平,说明 PCT 水平可作为 SCAP 诊断指标的同时,还可作为判断患者的病情进展及预后的指标。

CRP 为一种急性时相反应蛋白,能指示机体感染程度。在炎症发生过程中,早期会引起 CRP 的迅速升高,半衰期较短,不受病人的性别、年龄等诸多因素的影响,病情好转时,能快速恢复到正常水平,CRP 升高幅度和患者感染程度紧密相关,而且现有血清 CRP 水平测定技术成熟、快速简单且经济,较其他急性期反应物质有更有效的监测治疗效果^[26]。CRP 也不受抗炎药物、激素和免疫抑制剂等的影响,在观察治疗效果、指导治疗用药和停药等方面有重要的价值。

尿激酶型纤溶酶原激活物受体(uPAR)是一种纤溶酶原激活物,参与组织重构、炎症反应、肿瘤发生和血栓生成等病理生理过程,suPAR 存在于血清及其他体液中。研究表明,血清 suPAR 水平在结核^[27]等患者体内均有明显升高。在中性粒细胞、巨噬细胞和淋巴细胞等细胞表面,SuPAR 均有表达,在炎症反应中,血清 suPAR 水平有显著的增加^[28-30]。本研究无创组患者的插管率、ICU 住院天数和死亡率统计学上无显著差异,但均有一定程度上的降低。

综上所述,NIPPV 能显著改善 SCAP 患者的呼气情况,降低血清 PCT、CRP 和 suPAR 水平,对降低气管插管率、缩短 ICU 住院天数,降低患者死亡率有一定的效果。

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