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经鼻高流量氧疗对慢性阻塞性肺疾病急性加重期患者血气指标、膈肌功能及炎症反应的影响*

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摘要 目的:探讨经鼻高流量氧疗对慢性阻塞性肺疾病急性加重期(AECOPD)患者血气指标、膈肌功能及炎症反应的影响。**方法:**回顾性分析 2018 年 2 月~2020 年 8 月我院收治的 119 例 AECOPD 患者的临床资料。根据不同氧疗方法分为传统组 59 例和研究组 60 例,传统组给予传统氧疗,研究组给予经鼻高流量氧疗。对比两组治疗前后血气指标、膈肌功能及炎症反应的变化情况,观察两组不良反应发生率、治疗后再插管率、喘急胸闷和咳痰困难消失率。**结果:**研究组治疗后动脉血二氧化碳分压(PaCO_2)较传统组低,血氧饱和度(SaO_2)、动脉血氧分压(PaO_2)高于传统组(均 $P<0.05$)。研究组治疗后膈肌浅快呼吸指数(D-RSBI)、平静呼吸膈肌移动度(DEq)低于传统组(均 $P<0.05$)。研究组治疗后血清白细胞介素(IL)-6、肿瘤坏死因子(TNF)- α 低于传统组(均 $P<0.05$)。研究组治疗后再插管率低于传统组,喘急胸闷消失率、咳痰困难消失率高于传统组(均 $P<0.05$)。两组的不良反应总发生率组间对比无统计学差异($P>0.05$)。**结论:**与传统氧疗相比,经鼻高流量氧疗应用于 AECOPD 患者可有效改善血气指标、膈肌功能,减轻炎症反应,改善患者的临床症状。

关键词:经鼻高流量氧疗;慢性阻塞性肺疾病急性加重期;血气指标;膈肌功能;炎症反应

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Effects of Nasal High Flow Oxygen Therapy on Blood Gas Index, Diaphragm Function and Inflammatory Reaction in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease*

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ABSTRACT Objective: To investigate the effect of nasal high flow oxygen therapy on blood gas index, diaphragm function and inflammatory reaction in patients with acute exacerbation of chronic obstructive pulmonary disease (AECOPD). **Methods:** The clinical data of 119 patients with AECOPD in our hospital from February 2018 to August 2020 were retrospectively analyzed. According to different oxygen therapy methods, they were divided into traditional group with 59 cases and study group with 60 cases. The traditional group was treated with traditional oxygen therapy, and the study group was treated with nasal high flow oxygen therapy. The changes of blood gas index, diaphragm function and inflammatory reaction were compared between the two groups before and after treatment. The incidence of adverse reactions, reintubation rate after treatment, disappearance rate of dyspnea and chest tightness, expectoration difficulty were observed. **Results:** Arterial blood carbon dioxide partial pressure (PaCO_2) in the study group after treatment was lower than that in the traditional group, blood oxygen saturation (SaO_2), arterial partial pressure of oxygen (PaO_2) were higher than those in the traditional group (all $P<0.05$). After treatment, diaphragm shallow fast respiration index (D-RSBI), diaphragm movement of calm breathing (DEq) in the study group were lower than those in the traditional group (all $P<0.05$). After treatment, the levels of serum interleukin (IL)-6, tumor necrosis factor (TNF)- α in the study group were lower than those in the traditional group (all $P<0.05$). The reintubation rate in the study group after treatment was lower than that in the traditional group, and the disappearance rate of dyspnea, chest tightness and the disappearance rate of expectoration difficulty in the study group were higher than those in the traditional group (all $P<0.05$). There was no significant difference in the total incidence of adverse reactions between the two groups ($P>0.05$). **Conclusion:** Compared with traditional oxygen therapy, nasal high flow oxygen therapy in patients with AECOPD can effectively improve blood gas indexes, diaphragm function, reduce inflammatory response, and improve the clinical symptoms of patients.

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Key words: Nasal high flow oxygen therapy; Acute exacerbation of chronic obstructive pulmonary disease; Blood gas index; Diaphragm function; Inflammatory reaction

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前言

慢性阻塞性肺疾病(COPD)通常是由于机体暴露于有毒气体或颗粒环境中,从而导致气道慢性炎症、基底膜纤维化等,引起肺泡异常,最终引发持续的呼吸道症状和气流受限的一类疾病^[1,2]。根据病程 COPD 可分为急性加重期、稳定期,其中 COPD 急性加重期(AECOPD)是咳嗽、咳痰、呼吸困难等症状急性加重,若不及时进行干预治疗,可导致二氧化碳潴留、缺氧和呼吸衰竭,甚至危及患者生命^[3,4]。以往研究证实^[5],AECOPD 是导致 COPD 患者住院率、致残率及死亡率增加的重要原因。目前有关 AECOPD 的治疗除了常规对症药物治疗外,短时间内提高患者的有效通气量,并及时纠正低氧血症也是治疗该病的方法之一^[6]。经鼻高流量氧疗是将氧气经湿化和加热后给氧的新型方式,在多种呼吸衰竭疾病治疗中获得了满意的疗效^[7,8],但有关其与传统氧疗在 AECOPD 的治疗价值仍需进一步的验证。本研究通过分析经鼻高流量氧疗在 AECOPD 患者中的应用价值,以期为临床治疗提供参考。

1 资料与方法

1.1 一般资料

纳入标准:(1)诊断标准参考《慢性阻塞性肺疾病基层诊疗指南(2018 年)》^[9],意识清楚,血流动力学稳定;(2)耐受氧疗,均为轻中度 AECOPD。排除标准:(1)严重呼吸衰竭者;(2)存在肝肾等脏器严重功能障碍者;(3)支气管哮喘、肺癌等其他肺部疾病者;(4)胸廓畸形者;(5)合并严重心脏疾病、消化系统疾病者;(6)行机械通气的患者。回顾性分析 2018 年 2 月~2020 年 8 月我院收治的 AECOPD 患者($n=119$)的临床资料。根据不同氧疗方法分为传统组 59 例和研究组 60 例,传统组中男性、女性分别为 42 例、17 例;年龄 45~78 岁,平均(56.91 ± 5.27)岁;病情严重程度:轻度 32 例,中度 27 例;存在吸烟史者 37 例。研究组中男性、女性分别为 44 例、16 例;年龄 48~77 岁,平均(56.37 ± 6.19)岁;病情严重程度:轻度 34 例,中度 26 例;存在吸烟史者 39 例。两组一般资料对比无差异($P>0.05$),具有可比性。

1.2 方法

两组均给予糖皮质激素、解痉、支气管扩张药物、平喘、排痰、抗感染等治疗,传统组在常规基础上给予传统氧疗,具体操作为:常规清洁鼻腔,连接鼻导管,一端固定于鼻翼部,另一端经一侧鼻孔将鼻导管插入至鼻咽部。初始流量供氧情况依据患者是否伴有二氧化碳潴留情况而定。无二氧化碳潴留的初始流量供氧 2~4 L/min,伴有二氧化碳潴留的为 1~2 L/min。研究组在常规基础上给予经鼻高流量氧疗,具体操作为:常规清洁鼻腔,经鼻插管。将 OH-70C 高流量湿化氧疗治疗仪(湖南明康中锦医疗科技发展有限公司)、KL-20 空氧混合器(深圳科曼医疗设备有限公司)、SH530 湿化器(沛荷(上海)医疗器械有

限公司)等和氧源相连后,设置仪器参数:温度 34℃,流量 20 L/min,相对湿度 100%,吸入氧浓度(FiO_2)0.50。连接仪器,开始供氧治疗。两组患者待生命体征平稳时即可停止吸氧。

1.3 观察指标

(1)治疗前后采用美国 GEM3500 全自动血气分析仪检测两组患者血气指标:动脉血二氧化碳分压(PaCO_2)、血氧饱和度(SaO_2)、动脉血氧分压(PaO_2);(2)治疗前后检测两组患者膈肌功能指标:膈肌浅快呼吸指数(D-RSBI)、平静呼吸膈肌移动度(DEq)。具体操作方法为:测量前患者禁食 2 h,取半卧位,探头频率设置 3~5Hz,将 JH-3200 床旁超声仪(江苏佳华电子设备有限公司)探头置于右侧锁骨中线或腋前线与肋弓下缘交界处,探头指向头侧,分别测量 D-RSBI、DEq,均测量 3 次,取平均值;其中 $\text{D-RSBI} = \text{呼吸频率} / \text{膈肌活动度}$ 。(3)对比两组患者治疗后再插管率、喘急胸闷消失率、咳嗽困难消失率。(4)治疗前后采集患者清晨空腹静脉血 4~5 mL,采用酶联免疫吸附法(试剂盒购自上海酶联生物科技有限公司)对患者血清白细胞介素(IL)-6、肿瘤坏死因子(TNF)- α 水平进行检测。(5)记录两组治疗期间不良反应情况:如腹胀气、鼻粘膜干燥出血等发生情况。

1.4 统计学方法

采用 SPSS26.0 分析数据,计量资料均为正态分布,且方差齐性,采用 "均数 $\pm$ 标准差" 表示,采用成组 t 检验或校正 t 检验(两组间的比较)+ 采用配对 t 检验(同组内前后比较)。采用率表示计数资料,行卡方检验。检验水准为 $\alpha=0.05$ 。

2 结果

2.1 血气指标对比

治疗后两组患者 PaCO_2 降低, SaO_2 、 PaO_2 升高(均 $P<0.05$),研究组治疗后 PaCO_2 低于传统组, SaO_2 、 PaO_2 高于传统组(均 $P<0.05$),详见表 1。

2.2 膈肌功能指标对比

治疗后两组患者 D-RSBI、DEq 降低(均 $P<0.05$),研究组治疗后 D-RSBI、DEq 低于传统组(均 $P<0.05$),详见表 2。

2.3 炎症反应指标对比

两组患者治疗后血清 IL-6、TNF- α 降低(均 $P<0.05$),研究组治疗后血清 IL-6、TNF- α 低于传统组(均 $P<0.05$),详见表 3。

2.4 再插管率、喘急胸闷消失率、咳嗽困难消失率对比

研究组治疗后再插管率低于传统组,喘急胸闷消失率、咳嗽困难消失率高于传统组(均 $P<0.05$),详见表 4。

2.5 不良反应比较

两组不良反应总发生率组间对比无差异($P>0.05$),详见表 5。

3 讨论

COPD 作为一种结构性的呼吸系统慢性疾病,气流受限且

表 1 两组治疗前后血气指标对比($\bar{x} \pm s$)Table 1 Comparison of blood gas indexes between the two groups before and after treatment($\bar{x} \pm s$)

Groups	PaCO ₂ (mmHg)		SaO ₂ (%)		PaO ₂ (mmHg)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Traditional group(n=59)	53.49± 5.87	46.52± 5.48 [@]	79.43± 6.65	85.76± 5.84 [@]	48.67± 4.17	54.61± 5.89 [@]
Study group(n=60)	53.23± 6.65	41.06± 5.27 [@]	79.81± 5.39	90.41± 4.62 [@]	48.41± 4.53	60.48± 6.36 [@]
t	0.226	5.540	-0.343	-4.821	0.326	-5.222
P	0.822	0.000	0.732	0.000	0.745	0.000

Note: compared with the same group before treatment, [@]P<0.05.表 2 两组治疗前后膈肌功能指标对比($\bar{x} \pm s$)Table 2 Comparison of diaphragm function indexes before and after treatment in the two groups($\bar{x} \pm s$)

Groups	D-RSBI(n/mm·min)		DEq(mm)	
	Before treatment	After treatment	Before treatment	After treatment
Traditional group(n=59)	0.53± 0.09	0.41± 0.08 [@]	22.73± 2.63	18.60± 2.28 [@]
Study group(n=60)	0.51± 0.08	0.32± 0.06 [@]	22.81± 2.34	14.43± 2.17 [@]
t	1.282	6.950	-0.175	10.221
P	0.202	0.000	0.861	0.000

Note: compared with the same group before treatment, [@]P<0.05.表 3 两组治疗前后炎症反应指标对比($\bar{x} \pm s$)Table 3 Comparison of inflammatory reaction indexes between the two groups before and after treatment($\bar{x} \pm s$)

Groups	IL-6(ng/L)		TNF-α(ng/L)	
	Before treatment	After treatment	Before treatment	After treatment
Traditional group(n=59)	9.08± 1.33	6.83± 0.98 [@]	21.85± 3.28	17.14± 2.23 [@]
Study group(n=60)	9.14± 1.45	4.49± 0.76 [@]	21.68± 2.94	13.94± 2.19 [@]
t	-0.235	14.569	0.298	7.898
P	0.815	0.000	0.766	0.000

Note: compared with the same group before treatment, [@]P<0.05.

表 4 两组治疗后再插管率、喘急胸闷消失率、咳痰困难消失率对比 [n(%)]

Table 4 Comparison of reintubation rate, disappearance rate of dyspnea and chest tightness, and disappearance rate of expectoration difficulty between the two groups after treatment [n(%)]

Groups	Reintubation rate after treatment	Disappearance rate of dyspnea and	Disappearance rate of expectoration
		chest tightness	difficulty
Traditional group(n=59)	12(20.34)	41(69.49)	38(64.41)
Study group(n=60)	3(5.00)	53(88.33)	50(83.33)
χ^2	6.354	6.364	8.536
P	0.012	0.012	0.003

表 5 两组不良反应发生率对比 [例(%)]

Table 5 Comparison of the incidence of adverse reactions between the two groups [n(%)]

Groups	Abdominal distention	Dry bleeding of nasal mucosa	Total incidence
Traditional group(n=59)	3(5.08)	5(8.47)	8(13.56)
Study group(n=60)	2(3.33)	2(3.33)	4(6.67)
χ^2			1.559
P			0.212

具有不可逆性,尤其是 AECOPD 的患者症状呈进行性加重,局部炎性反应加重,柱状上皮细胞纤毛输送系统形成障碍,痰液增多且难以排出体外,气道阻力进一步增加,导致患者肺部呼气末残气量及肺气量增多^[10-12]。痰液增多引起气道狭窄,增加患者的呼气负荷,长期处于高负荷状态下,最终导致低氧及高碳酸血症,引起呼吸衰竭甚至死亡^[13-15]。以往的研究发现^[16],吸氧、排痰、支气管扩张药物、解痉、糖皮质激素、平喘、抗感染等常规治疗可有效控制 AECOPD 的患者病情。氧疗是 AECOPD 治疗的基本方法,供氧治疗能够迅速提升血氧含量,缓解器官缺氧状况,改善预后^[17]。传统氧疗方式为经鼻导管给氧,可有效避免高碳酸血症可能引起的二氧化碳麻醉,刘亚萍^[18]等学者认为保守性氧疗治疗能显著改善 AECOPD 患者的肺功能和缺氧症状。经鼻高流量氧疗能够对所供氧气进行加温和加湿,刘峰^[19]等人证实经鼻高流量湿化氧疗可明显改善 AECOPD 患者的临床症状,但经鼻高流量氧疗目前仍属于小范围应用的氧疗方法,其与传统氧疗治疗 AECOPD 的疗效优劣仍需要总结和验证。

低氧血症、高碳酸血症等现象的发生是导致 AECOPD 发生呼吸衰竭的重要因素,其中 PaCO_2 的上升以及 SaO_2 、 PaO_2 的降低可刺激机体的循环和呼吸系统,表现为心脏排血量 and 心脏负荷增加、心率及呼吸频率加快,严重影响患者的生命质量^[20-22]。本次研究中,经鼻高流量氧疗治疗 AECOPD 患者血气分析指标改善更佳,可能是因为经鼻高流量氧疗可促进呼吸道纤毛功能恢复,提高了肺部顺应性和氧气利用率^[23]。膈肌是人体最主要的呼吸肌,由于 AECOPD 患者长期气流受限,会导致膈肌负荷增加,致使膈肌损伤和膈肌疲劳,不利于患者呼吸^[24]。D-RS-BI、DEq 是临床反映膈肌功能的常见指标,本研究发现,经鼻高流量氧疗治疗可更好地改善人体的膈肌功能,杨圣强等学者^[25]的研究报道也证实:经鼻高流量氧疗对 AECOPD 患者膈肌功能恢复具有促进作用,分析其原因主要是高流量氧疗可提供充足的氧气流量,氧流量较高可有效冲刷气道,进而有效清除体内多余的二氧化碳,促进肺部气体交换,改善患者通气功能,减少呼吸功耗,进而有利于改善膈肌疲劳,减轻膈肌损伤^[26]。COPD 主要的病理生理学机制是慢性气道炎症,IL-6、TNF- α 可促进中性粒细胞凋亡的减少及淋巴细胞的过度凋亡,引起肺组织的结构功能出现损伤,导致患者病情加重^[27]。本次研究中,经鼻高流量氧疗治疗的患者炎性反应得到显著缓解,可能是该氧疗方式提供加热加湿的气体,促进呼吸道改善,减轻机体高反应性或刺激性,从而降低炎性因子水平^[28]。研究组治疗后的喘急胸闷消失率、咳痰困难消失率高于传统组,再插管率则低于传统组,说明经鼻高流量氧疗可使氧浓度维持稳定,使氧流量抑制高于患者吸气时最高氧流量,弥补传统氧疗方式中供氧不稳定、氧流量偏少的不足^[29]。经鼻高流量氧疗提供的氧气进行了“加湿”这一过程,氧气流经人体气道时可有效促进气道痰性分泌物的湿化,将痰液分泌出体外,降低气道刺激,改善患者喘急胸闷等症状,降低治疗后再插管率^[30,31]。两组不良反应发生率对比无差异,可见患者对经鼻高流量氧疗有较好的耐受性。

综上所述,经鼻高流量氧疗治疗 AECOPD 患者可获得更好的临床效果,在改善血气指标、膈肌功能、炎性指标方面效果确切,可有效缓解临床症状。本次研究不足之处为经鼻高流量氧疗的最适宜氧浓度尚未分析,有待进一步的研究。

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