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## 氨茶碱及高压氧治疗老年呼吸衰竭疗效及对患者肺功能影响 \*

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**摘要** 目的:探讨氨茶碱及高压氧治疗老年呼吸衰竭疗效及对患者肺功能影响。方法:采取回顾性研究法,选择 2016 年 8 月到 2021 年 5 月在本院诊治的老年呼吸衰竭患者 84 例作为研究对象,以随机 1:1 数字表法方式把患者平均分为对照组和联合组各 42 例。两组都给予无创机械通气治疗,对照组给予雾化吸入氨茶碱治疗,联合组在对照组治疗的基础上给予高压氧治疗,两组都治疗观察 14 d。结果:两组治疗后的动脉血氧分压(PaO<sub>2</sub>)值显著升高,动脉二氧化碳分压(PaCO<sub>2</sub>)值显著降低,对比存在明显差异,治疗后联合组的 PaCO<sub>2</sub>、PaO<sub>2</sub> 值与对照组对比存在明显差异( $P<0.05$ )。治疗后,联合组总有效率为 97.6%,高于对照组 83.3% ( $P<0.05$ )。治疗后,联合组与对照组的一秒用力呼气容积(FEV<sub>1</sub>)/用力肺活量(FVC)值都明显高于治疗前,联合组明显高于对照组 ( $P<0.05$ )。治疗后联合组与对照组的血清白细胞介素(IL)-6、IL-10 水平都呈现明显下降趋势,且联合组明显低于对照组( $P<0.05$ )。结论:氨茶碱联合高压氧治疗老年呼吸衰竭能抑制 IL-6、IL-10 的表达,改善机体的血气状况与肺功能,提高总体治疗效果,减少并发症的发生,值得在临床上推广使用。

**关键词:**氨茶碱;高压氧;老年人;呼吸衰竭

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## Efficacy of Aminophylline and Hyperbaric Oxygen in the Treatment of Senile Respiratory Failure and Their Effects on Pulmonary Function\*

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**ABSTRACT Objective:** To investigate the efficacy of aminophylline and hyperbaric oxygen in the treatment of elderly patients with respiratory failure and their effects on pulmonary function. **Methods:** Used a retrospective study method, from August 2016 to May 2021, 84 cases of elderly patients with respiratory failure who were diagnosed and treated in our hospital were selected as the research objects, and the patients were equally divided into the control group and the combination group by random 1:1 digital table method. Both groups were treated with non-invasive mechanical ventilation, the control group were treated with nebulized aminophylline, and the combination group were treated with hyperbaric oxygen on the basis of the treatment of the control group. Both groups were treated for 14 days. **Results:** After treatment, the PaO<sub>2</sub> values of the two groups were significantly increased, and the PaCO<sub>2</sub> values were decreased, and there were difference compared between the two groups( $P<0.05$ ). The total effective rates after treatment in the combination group were 97.6%, which were significantly higher than 83.3% in the control group ( $P<0.05$ ). After treatment, the FEV<sub>1</sub>/FVC values of the combination group and the control group were significantly higher than those before treatment ( $P<0.05$ ), and the combination group were higher than that before treatment, and were higher than the control group( $P<0.05$ ). After treatment, the serum interleukin(IL)-6 and IL-10 levels in the combination group and the control group were showed significant downward trend, and the combination group were lower than the control group ( $P<0.05$ ). **Conclusion:** Aminophylline combined with hyperbaric oxygen in the treatment of elderly respiratory failure can inhibit the expression of IL-6 and IL-10, improve the body's blood gas status and lung function, improve the overall treatment effect, and reduce the incidence of complications, which is worthy of clinical promotion.

**Key words:** Aminophylline; Hyperbaric oxygen; Elderly; Respiratory failure

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## 前言

呼吸衰竭(Respiratory failure, RF)是指各种原因引起的肺通气(和/或)换气功能严重障碍,可导致低氧血症(或不伴)高碳酸血症<sup>[1]</sup>。呼吸衰竭在老年人的发病率比较高,其持续发病可引起肺的持续性损伤,诱发难治性呼吸衰竭,出现高热、头痛、胸痛、干咳、寒战等症状,未经有效治疗者的病死率在 30.0 %以上<sup>[2,3]</sup>。现代研究表明呼吸衰竭是机体失控的炎症反应的结果,机体受到各种原因释放产生炎症因子<sup>[4]</sup>。机械通气为呼吸衰竭的重要治疗方法之一,其可清除相关炎症介质,恢复炎症介质平衡,进而稳定患者生命体征<sup>[5,6]</sup>。不过机械通气无法成为长期治疗方法,且长期使用对于患者的有一定的创伤。氨茶碱是当前具有抗炎兼并扩张气道效应的药物,可以减轻黏膜水肿和支气管痉挛<sup>[7,8]</sup>。高压氧(Hyperbaric Oxygen, HBO)在各种危重疾病的早期治疗方面有其独特的作用,高压氧可增加血氧含量,提高血氧分压与血氧弥散力,加速受损细胞的恢复,快速改善机体缺氧状态,促进病情转归,从而促进改善患者的预后<sup>[9,10]</sup>。不过单一的治疗方法难以达到较好的效果,因此探索老年呼吸衰竭的联合治疗的新途径、新思路是非常必要的<sup>[11,12]</sup>。本文具体

探讨与分析了氨茶碱及高压氧治疗老年呼吸衰竭疗效及对患者肺功能影响,进而促进临床上联合治疗的应用。

## 1 资料与方法

### 1.1 研究对象

在研究方法上,采取回顾性研究法,选择 2016 年 8 月到 2021 年 5 月在空军第九八六医院诊治的老年呼吸衰竭患者 84 例作为研究对象。

纳入标准:符合呼吸衰竭的诊断标准;对胸部进行 X 线检查,发现间质性改变或斑片状、片状浸润性阴影,或有胸腔积液存在;年龄 60-80 岁;所有患者均持续发热;自愿签署知情同意书者;临床资料完整;患者治疗期间生命体征稳定,无出现死亡情况。

排除标准:合并心血管疾病、肝肾功能障碍或恶性肿瘤者;合并传染性疾病者;合并精神疾病、语言障碍者、听力障碍。

以随机 1:1 数字表法方式把患者平均分为对照组和联合组各 42 例,两组一般资料对比无差异( $P>0.05$ )。详见表 1。经本院伦理委员会批准者。

表 1 两组一般资料对比

Table 1 Comparison of the two groups of general data

| Groups        | n  | Systolic blood pressure | Diastolic blood pressure | Heart rate        | Age (year)  | Admission body temperature (°C) | Gender (male / female) |
|---------------|----|-------------------------|--------------------------|-------------------|-------------|---------------------------------|------------------------|
|               |    | (mmHg)                  | (mmHg)                   | (secondary / min) |             |                                 |                        |
| Joint group   | 42 | 126.22± 10.48           | 76.87± 8.14              | 92.17± 1.58       | 65.92± 4.92 | 38.99± 0.78                     | 22/20                  |
| Matched group | 42 | 126.98± 9.89            | 76.27± 8.21              | 92.54± 2.16       | 65.22± 5.19 | 38.29± 0.99                     | 21/21                  |

### 1.2 治疗方法

两组都给予无创机械通气治疗,选择合适尺寸的鼻 / 面罩,连接美国飞利浦伟康公司的双水平无创呼吸机 ST 型呼吸机,使用双水平气道正压通气模式。通气参数:呼气压力 4-8 cm H<sub>2</sub>O,吸气压力 16-20 cm H<sub>2</sub>O,面罩旁供氧 5-10 L/min。

对照组:给予雾化吸入氨茶碱治疗,将 10 mg 氨茶碱(国药准字 H20124248,本溪恒康制药有限公司)混入生理水 10 mL 每次雾化吸入 10 min,1 次 / d。

联合组:在对照组治疗的基础上给予高压氧治疗,使用三舱七门高压氧舱群,空气加压的压力 0.2 mPa,加压 15 min,中间吸氧 30× 2 min,然后均匀减压至 0 mPa 再出舱,1 次 / d。

两组都治疗观察 14 d。

### 1.3 观察指标

(1)在治疗前与治疗后,测定与记录所有患者血气指标,主要包括动脉血氧分压(PaO<sub>2</sub>)以及动脉二氧化碳分压(PaCO<sub>2</sub>)。

(2)所有患者在治疗前后进行肺功能的测定与记录,主要为一秒用力呼气容积(Forced expiratory volume in one second, FEV<sub>1</sub>) / 用力肺活量(Forced vital capacity, FVC)值。

(3)所有患者在治疗后进行总体疗效评价,显效:与治疗前比较,临床症状体征有极其显著的减轻;有效:与治疗前比较,临床症状、体征有所减轻;无效:没有达到上述标准或者出现恶化。总有效率=(显效+有效) / 总例数× 100.0 %。

(4)所有患者在治疗前后抽取静脉血,在 2 h 内送检测科室,采用酶联免疫法检测血清白细胞介素(Interleukin, IL)-6、IL-10 含量。

(5)记录与观察两组所有患者在治疗期间出现的肝肾功能异常、感染、下肢静脉血栓、尿潴留等并发症情况。

### 1.4 统计方法

运用软件 SPSS19.00 展开分析,当  $P<0.05$ ,则表明存在显著差异。利用均数± 标准差来描述计量数据,采用 % 来描述计数数据,两两对比开展 t 检验与卡方  $\chi^2$  检验,检验水准为  $\alpha=0.05$ 。

## 2 结果

### 2.1 血气指标变化对比

两组治疗后的 PaO<sub>2</sub> 值显著升高,PaCO<sub>2</sub> 值显著降低,对比存在明显差异,治疗后联合组的 PaCO<sub>2</sub>、PaO<sub>2</sub> 值与对照组对比存在明显差异( $P<0.05$ )。详见表 2。

### 2.2 总有效率对比

联合组治疗后的总有效率为 97.6 %,显著高于对照组的 83.3 %( $P<0.05$ )。详见表 3。

### 2.3 肺功能变化对比

治疗后联合组与对照组的 FEV<sub>1</sub>/FVC 值都明显高于治疗前,联合组明显高于对照组( $P<0.05$ )。详见表 4。

表 2 治疗前后两组患者血气指标变化对比(mmHg, 均数± 标准差)

Table 2 Comparison of blood gas index changes before and after treatment (mmHg, mean ± standard deviation)

| Groups        | n  | PaO <sub>2</sub> |                           | PaCO <sub>2</sub> |                           |
|---------------|----|------------------|---------------------------|-------------------|---------------------------|
|               |    | Pretherapy       | Post-treatment            | Pretherapy        | Post-treatment            |
| Joint group   | 42 | 50.55± 2.84      | 85.37± 3.39 <sup>ab</sup> | 78.93± 3.95       | 45.20± 4.21 <sup>ab</sup> |
| Matched group | 42 | 50.11± 3.38      | 73.67± 4.44 <sup>a</sup>  | 78.24± 4.13       | 55.39± 2.99 <sup>a</sup>  |

Note: <sup>a</sup>*P*<0.05 compared with that pretherapy; <sup>b</sup>*P*<0.05 when compared with the matched group after treatment, the same below.

表 3 治疗后总有效率对比(n)

Table 3 Comparison of total response rate after treatment (n)

| Groups        | n  | Excellence | Valid | Invalid | Total effective rate    |
|---------------|----|------------|-------|---------|-------------------------|
| Joint group   | 42 | 38         | 3     | 1       | 41(97.6 %) <sup>b</sup> |
| Matched group | 42 | 22         | 13    | 7       | 35(83.3 %)              |

表 4 FEV<sub>1</sub>/FVC 值变化对比(% ,均数± 标准差)

Table 4 Comparison of FEV<sub>1</sub> / FVC values (% , mean ± standard deviation)

| Groups        | n  | Pretherapy   | Post-treatment             |
|---------------|----|--------------|----------------------------|
| Joint group   | 42 | 76.22± 18.49 | 90.35± 12.76 <sup>ab</sup> |
| Matched group | 42 | 77.20± 17.33 | 85.91± 10.35 <sup>a</sup>  |

#### 2.4 炎症因子表达变化对比

联合组较对照组低(*P*<0.05)。详见表 5。

治疗后联合组与对照组的血清 IL-6、IL-10 水平均下降,且

表 5 血清 IL-6、IL-10 变化对比(pg/mL, 均数± 标准差)

Table 5 Comparison of serum IL-6 and IL-10 changes (pg/mL, mean ± standard deviation)

| Groups        | n  | IL-6          |                            | IL-10         |                            |
|---------------|----|---------------|----------------------------|---------------|----------------------------|
|               |    | Pretherapy    | Post-treatment             | Pretherapy    | Post-treatment             |
| Joint group   | 42 | 350.58± 15.22 | 96.21± 18.25 <sup>ab</sup> | 126.35± 9.55  | 45.85± 10.98 <sup>ab</sup> |
| Matched group | 42 | 355.51± 13.25 | 145.01± 12.62 <sup>a</sup> | 125.96± 11.85 | 80.90± 12.51 <sup>a</sup>  |

#### 2.5 并发症发生情况对比

滞留等并发症发生率为 4.8 %,显著低于对照组的 26.2 %(*P*<0.

联合组治疗期间的肝肾功能异常、感染、下肢静脉血栓、尿 05)。详见表 6。

表 6 治疗期间并发症发生情况对比(n)

Table 6 Comparison of complications (n)

| Groups        | n  | Abnormal liver and kidney function | Infect | Lower limb venous thrombosis | Retention of urine | Summation            |
|---------------|----|------------------------------------|--------|------------------------------|--------------------|----------------------|
| Joint group   | 42 | 1                                  | 0      | 0                            | 1                  | 2(4.8%) <sup>b</sup> |
| Matched group | 42 | 3                                  | 3      | 2                            | 3                  | 11(26.2%)            |

### 3 讨论

呼吸衰竭是临床上的比较危重疾病,常伴随有各种并发症,有较高死亡率与致残率<sup>[13,14]</sup>。当前由于各种因素的影响,老年呼吸衰竭的肺炎发病率增高,临床表现存在多样性特征,可损伤患者体内多个脏器<sup>[15]</sup>。机械通气可改善患者氧和功能,迅

速缓解患缺氧症状,达到改善肺功能的目的,但是长期治疗的效果不佳。现代研究表明呼吸衰竭的特征性改变为气道、肺实质以及肺血管的慢性炎症<sup>[16,17]</sup>。

本研究显示两组治疗后的 PaO<sub>2</sub> 值显著升高,PaCO<sub>2</sub> 值显著降低,对比存在明显差异,治疗后联合组的 PaCO<sub>2</sub>、PaO<sub>2</sub> 值与对照组对比存在明显差异;联合组治疗后的总有效率为 97.6 %,

显著高于对照组的 83.3 %,表明氨茶碱联合高压氧治疗老年呼吸衰竭能改善血气指标,提高总体疗效。分析可知,氨茶碱可清除气道内分泌物维持通畅,对释放过敏介质和活化炎症细胞有抑制作用,同时对于呼吸肌的收缩功能具有明显改善作用,预防肥大细胞脱颗粒从而引发黏膜下水肿和迟发性反应<sup>[18]</sup>。其中雾化吸入治疗的优点是药物以气雾形式经气道直接到达病变部位,从而提高治疗效果。高压氧的应用能阻断机体缺氧状态,迅速增加血氧含量,提高动脉血氧分压,阻止或减轻相关细胞的损伤,改善组织的微循环,辅助改善心肺功能,从而促进病情转归<sup>[19,20]</sup>。

呼吸衰竭是一种致死率较高的危重症,可造成机体细胞缺氧,严重时致多脏器衰竭致死<sup>[21,22]</sup>。本研究显示治疗后联合组与对照组的 FEV<sub>1</sub>/FVC 值都明显高于治疗前,联合组明显高于对照组;联合组治疗期间的肝肾功能异常、感染、下肢静脉血栓、尿潴留等并发症发生率为 4.8 %,显著低于对照组的 26.2 %,表明氨茶碱联合高压氧治疗老年呼吸衰竭能改善肺功能,减少并发症的发生。该结果与 Copeland H 等人的报道<sup>[23]</sup>具有相似性。分析可知,氨茶碱可抑制平滑肌细胞内的磷酸二酯酶,阻断腺苷受体感染平滑肌细胞内钙离子移动,激活蛋白酶 A 和蛋白酶 G,进而松弛支气管平滑肌<sup>[24]</sup>。高压氧治疗可迅速缓解患者缺氧症状,使患者氧合水平得到改善,有助于提高其他治疗手段的治疗效果<sup>[25]</sup>。并且其能有效促进排除患者的二氧化碳,能让受伤肺组织暂时休息,以等待其功能恢复或为其他治疗手段提供时间<sup>[26]</sup>。

呼吸衰竭的发病还能够释放多种趋化因子,对白细胞进行趋化,进而对患者肺部造成持续损害,而炎症介质的过度释放将导致呼吸衰竭患者疾病的恶化<sup>[27]</sup>。并且呼吸衰竭可促使自由基在脑内大量增加,使细胞膜系统和血脑屏障损害,脑血管可发生痉挛、麻痹或破坏,导致多器官功能障碍<sup>[28]</sup>。本研究显示治疗后联合组与对照组的血清 IL-6、IL-10 水平都呈现明显下降趋势,且联合组明显低于对照组,表明氨茶碱联合高压氧治疗老年呼吸衰竭能抑制 IL-6、IL-10 的表达。该结果与 Wang CH 等人的报道<sup>[29]</sup>具有相似性。分析可知,氨茶碱可兴奋呼吸中枢,舒张血管平滑肌,降低气道炎性反应;高压氧能迅速增加血氧含量,增加机体的有氧代谢,提高血氧弥散范围,打断呼吸衰竭的恶性循环,从而抑制 IL-6、IL-10 的表达,减轻或阻断机体的炎症反应,使得紊乱的免疫系统趋于平衡<sup>[30]</sup>。但本研究存在一定不足,入组病例较少,具体作用机制还不太明确,也未进行随访分析,将在下一步进行深入分析探讨。

总之,氨茶碱联合高压氧治疗老年呼吸衰竭能抑制 IL-6、IL-10 的表达,改善机体的血气状况与肺功能,提高总体治疗效果,减少并发症的发生,值得在临床上推广使用。

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