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## 不同吸痰深度对高血压脑出血气管切开患者血氧饱和度的影响

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**[摘要]** 目的: 探讨不同吸痰深度对高血压脑出血气管切开患者血氧饱和度的影响。方法: 选取2020年1月至2022年1月淮安市第一人民医院收治的高血压脑出血行气管切开术的70例患者, 所有患者均在气管切开术后第2天进行深部、浅部吸痰各4次, 比较不同吸痰深度吸痰前后患者脉搏血氧饱和度(pulse oxygen saturation, SpO<sub>2</sub>)、脑组织血氧饱和度(cerebral tissue oxygen saturation, rSO<sub>2</sub>)水平的变化情况。结果: 深部与浅部吸痰后即刻SpO<sub>2</sub>水平均低于吸痰前1 min (均P<0.05), 吸痰后3、5、10 min的SpO<sub>2</sub>水平均高于吸痰前1 min (均P<0.05); 深部与浅部吸痰相比, 吸痰前后各时间点SpO<sub>2</sub>水平差异均无统计学意义(均P>0.05)。深部与浅部吸痰后各时间点的rSO<sub>2</sub>水平均高于吸痰前1 min (均P<0.05); 深部与浅部吸痰相比, 吸痰前后各时间点rSO<sub>2</sub>水平差异均无统计学意义(均P>0.05)。患者血压水平在吸痰后首先增高再逐渐下降至吸痰前1 min水平, 深部、浅部吸痰患者血压变化规律类似, 且深部吸痰患者吸痰后5 min恢复至吸痰前水平, 浅部吸痰患者吸痰3 min恢复至吸痰前水平, 吸痰3 min内深部吸痰相较于浅部吸痰患者血压增加更明显(P<0.05)。结论: 深部吸痰、浅部吸痰应用于高血压脑出血气管切开术患者的吸痰效果一致, 且对血氧饱和度的影响无明显差异, 临床建议实施浅部吸痰, 以减少不良反应的发生。

**[关键词]** 深部吸痰; 浅部吸痰; 高血压脑出血; 气管切开; 血氧饱和度

## Effect of different sputum suction depths on blood oxygen saturation in patients with hypertensive cerebral hemorrhage and tracheotomy

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**Abstract** **Objective:** To investigate the effect of different sputum suction depths on blood oxygen saturation in patients with hypertensive cerebral hemorrhage and tracheotomy. **Methods:** From January 2020 to January 2022, 70 patients with hypertensive cerebral hemorrhage who underwent tracheotomy in Huai'an First People's Hospital were selected. All patients underwent deep and shallow sputum suction each for 4 times on the 2nd day after tracheotomy, and the changes of pulse oxygen saturation (SpO<sub>2</sub>) and cerebral tissue oxygen saturation (rSO<sub>2</sub>) levels before and after suction at different sputum suction depths were compared. **Results:** The SpO<sub>2</sub> levels

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immediately after suction were lower than 1 min before suction in patients with deep and shallow sputum suction (both  $P < 0.05$ ), while the  $SpO_2$  levels at 3, 5, and 10 min after suction were all higher than that 1 min before suction (all  $P < 0.05$ ). There was no statistically significant difference in  $SpO_2$  levels at all time points between patients with deep and shallow sputum suction (all  $P > 0.05$ ). The  $rSO_2$  levels at all time points after suction were higher than that 1 min before suction in patients with deep and shallow sputum suction (all  $P < 0.05$ ). There was no statistically significant difference in  $rSO_2$  levels at all time points between patients with deep and shallow sputum suction (all  $P > 0.05$ ). The blood pressure levels of patients first increased after sputum suction and then gradually decreased to the level 1 min before sputum aspiration. The changes in blood pressures of patients with deep and shallow suction had similar patterns. Patients with deep sputum suction returned to pressure levels before suction at 5 min after suction, while those with shallow sputum suction returned to pressure levels before suction at 3 min after suction. Elevation of blood pressures within 3 min after suction was more obvious in patients with deep sputum suction compared with those with shallow sputum suction ( $P < 0.05$ ). **Conclusion:** Deep and shallow sputum suction have the same effect on patients with hypertensive cerebral hemorrhage and tracheotomy, and there is no statistically significant difference in respect of the effect on blood oxygen saturation. It is clinically recommended to implement shallow sputum suction to reduce the occurrence of adverse reactions.

**Keywords** deep sputum suction; shallow sputum suction; hypertensive cerebral hemorrhage; tracheotomy; blood oxygen saturation

临床对高血压脑出血术后患者常给予建立人工气道以保持气道通畅, 但人工气道会导致痰液等于肺内或气管内淤积, 使肺部感染发生率明显增加, 影响预后<sup>[1]</sup>, 而吸痰能够有效清除痰液等分泌物。美国呼吸协会(American Association for Respiratory Care, AARC)临床实践指南2010<sup>[2]</sup>指出: 有效吸痰是清除患者气道异物、维持呼吸道通畅、预防肺部并发症的重要措施。但吸痰可影响高血压脑出血患者的颅内压, 严重者可造成患者脑部的二次损伤<sup>[3]</sup>。因此, 如何在确保吸痰有效性的同时保障患者安全是目前研究的热点。吸痰深度是影响吸痰效果的重要因素<sup>[4]</sup>, 目前国内外对于吸痰深度尚无统一标准。因此, 本研究对高血压脑出血行气管切开术患者同时实施深部和浅部吸痰, 分析吸痰效果。

## 1 对象与方法

### 1.1 对象

选择2020年1月至2022年1月淮安市第一人民医院收治的高血压脑出血行气管切开术的70例患者, 其中男37例, 女33例; 年龄28~77(53.27±8.69)岁; 脉搏血氧饱和度(pulse oxygen saturation,  $SpO_2$ )水平为91%~100%(96.91±2.53)%; 脑组织血氧饱和度(cerebral tissue oxygen saturation,  $rSO_2$ )水平为61%~82%(72.06±4.19)%; 格拉斯哥昏迷评分为

3~10(6.77±1.39)。纳入标准: 经计算机X线断层照相技术(computed tomography, CT)、磁共振成像(magnetic resonance imaging, MRI)等影像学检查结合临床症状检查确诊为高血压脑出血; 行气管切开术; 患者及家属均签署知情同意书。排除标准: 合并严重的心脏病; 合并严重的慢性肺部疾病; 合并严重的肝、肾等脏器功能不全; 合并严重的术后并发症; 合并感染性疾病; 使用呼吸机; 术后3 d死亡。本研究经淮安市第一人民医院医学伦理委员会批准(审批号: KY-2020-040-02)。

### 1.2 方法

患者在气管切开术后第2天实施吸痰, 每位患者均监测吸痰8次, 深部和浅部吸痰各4次。浅部吸痰方法如下: 将吸痰管置入患者气道超过气道套管头端1~2 cm, 作为吸痰管插入深度; 深部吸痰方法如下: 干预人员将吸痰管置入人工气道内, 遇阻力后回抽吸痰管1~2 cm, 吸痰管进入气道的深度为12~13 cm。在对患者实施吸痰时, 确保无菌操作, 在实施吸痰操作前患者或家属签署有创检查诊疗同意书。干预人员采用密闭式吸痰, 调整吸痰负压为120 mmHg(1 mmHg=0.133 kPa), 先将吸痰管插入预定吸痰深度, 然后打开负压, 吸痰的同时旋转吸痰管并逐步后退, 每次时间在15 s以内。此外, 吸痰操作仅在患者存在分泌物时进行, 吸痰前30~60 s给予100%氧以缓解吸痰所造成的血氧

水平下降。

### 1.3 观察指标

监测并记录每次深部吸痰、浅部吸痰前1 min、吸痰后即刻、吸痰后1、3、5、10 min的SpO<sub>2</sub>、rSO<sub>2</sub>、收缩压、舒张压及平均动脉压水平。

### 1.4 统计学处理

采用SPSS 22.0统计学软件进行数据分析。不同吸痰深度吸痰前后SpO<sub>2</sub>、rSO<sub>2</sub>、收缩压、舒张压及平均动脉压水平变化以均数±标准差( $\bar{x}\pm s$ )表示, 比较采用 $t$ 检验。 $P<0.05$ 为差异有统计学

意义。

## 2 结果

### 2.1 不同吸痰深度吸痰前后 SpO<sub>2</sub> 水平比较

深部和浅部吸痰后即刻SpO<sub>2</sub>水平均低于吸痰前1 min (均 $P<0.05$ ), 吸痰后3、5、10 min的SpO<sub>2</sub>水平均高于吸痰前1 min (均 $P<0.05$ ); 深部与浅部吸痰相比吸痰前后各时间点SpO<sub>2</sub>水平差异均无统计学意义(均 $P>0.05$ , 表1)。根据SpO<sub>2</sub>水平变化曲线, SpO<sub>2</sub>水平在吸痰后即刻明显降低, 吸痰后1 min恢复至吸痰前水平(图1)。

表1 不同吸痰深度吸痰前后SpO<sub>2</sub>水平变化( $n=70$ )

Table 1 Changes of SpO<sub>2</sub> levels before and after sputum suction at different depths ( $n=70$ )

组别	吸痰次数	吸痰前 1 min/%	吸痰后 即刻/%	吸痰后 1 min/%	吸痰后 3 min/%	吸痰后 5 min/%	吸痰后 10 min/%
深部吸痰	280	97.51 ± 2.36	96.49 ± 2.93*	97.70 ± 2.18	97.89 ± 1.97*	97.97 ± 1.94*	98.01 ± 1.92*
浅部吸痰	280	97.42 ± 2.33	96.63 ± 2.89*	97.61 ± 2.23	97.80 ± 1.87*	97.88 ± 2.05*	97.96 ± 1.98*
$t$	—	0.454	0.569	0.483	0.554	0.534	0.303
$P$	—	0.650	0.569	0.629	0.580	0.594	0.762

与吸痰前1 min比较, \* $P<0.05$ 。

Compared with 1 min before suction, \* $P<0.05$ .

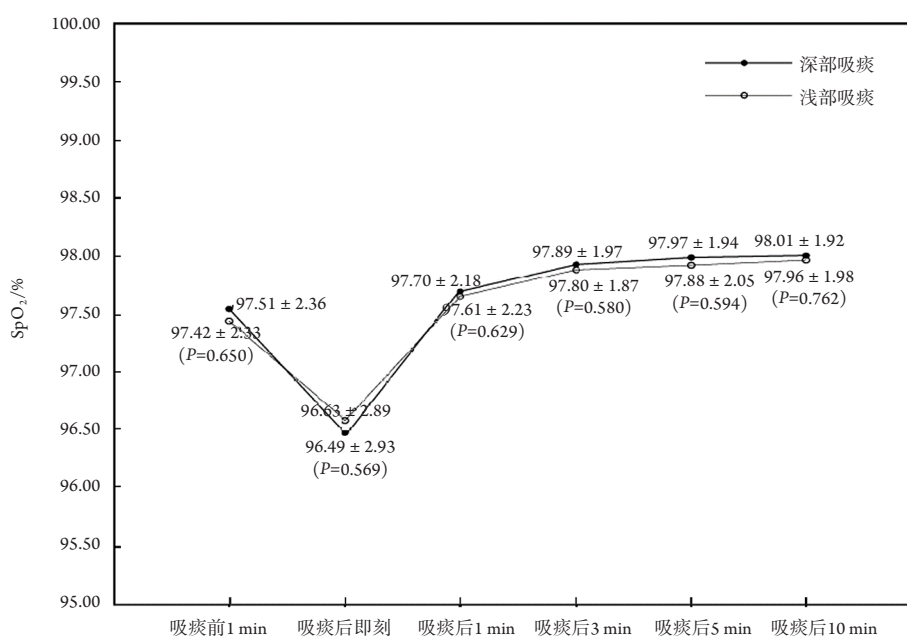


图1 深部与浅部吸痰患者不同时间点血氧饱和度变化曲线

Figure 1 Change curve of blood oxygen saturation at different time points in patients with deep and shallow sputum suction

## 2.2 不同吸痰深度吸痰前后 rSO<sub>2</sub> 水平比较

深部和浅部吸痰后即刻、吸痰后1、3、5、10 min的rSO<sub>2</sub>水平均高于吸痰前1 min (均 $P<0.05$ ), 深部与浅部吸痰相比吸痰前后各时间点rSO<sub>2</sub>水平差异均无统计学意义(均 $P>0.05$ , 表2)。根据rSO<sub>2</sub>水平变化曲线, rSO<sub>2</sub>水平在吸痰后3 min达到峰值(图2)。

## 2.3 不同吸痰深度吸痰前后血压水平比较

深部吸痰患者收缩压、舒张压、平均动脉压水平在吸痰后即刻、吸痰后1和3 min均高于吸痰前1 min (均 $P<0.05$ ); 吸痰后5 min各血压恢

复至吸痰前1 min水平(均 $P>0.05$ ), 吸痰后10 min低于吸痰前1 min水平( $P<0.05$ )。浅部吸痰患者收缩压在吸痰后即刻、吸痰后1 min高于吸痰前1 min水平( $P<0.05$ ), 吸痰后5和10 min均低于吸痰前1 min水平(均 $P<0.05$ ); 舒张压和平均动脉压在吸痰后即刻及吸痰后1 min均高于吸痰前1 min水平(均 $P<0.05$ ), 在吸痰后3 min恢复至吸痰前1 min水平( $P>0.05$ ), 在吸痰后5和10 min均低于吸痰前1 min水平(均 $P<0.05$ )。除在吸痰后1 min深部吸痰组收缩压高于浅部吸痰组外, 其余各时间点的差异均无统计学意义( $P>0.05$ , 表3)。

表2不同吸痰深度吸痰前后rSO<sub>2</sub>水平变化( $n=70$ )

Table 2 Changes of rSO<sub>2</sub> levels before and after sputum suction at different depths ( $n=70$ )

组别	吸痰次数	吸痰前 1 min/%	吸痰后 即刻/%	吸痰后 1 min/%	吸痰后 3 min/%	吸痰后 5 min/%	吸痰后 10 min/%
深部吸痰	280	73.86 ± 4.31	74.62 ± 4.36*	75.31 ± 4.54*	75.88 ± 4.41*	75.79 ± 4.48*	75.30 ± 4.39*
浅部吸痰	280	73.80 ± 4.25	74.56 ± 4.30*	75.01 ± 4.42*	75.49 ± 4.44*	75.22 ± 4.37*	74.98 ± 4.32*
<i>t</i>	—	0.166	0.164	0.792	1.043	1.524	0.869
<i>P</i>	—	0.868	0.870	0.429	0.298	0.128	0.385

与吸痰前1 min比较, \* $P<0.05$ 。

Compared with 1 min before suction, \* $P<0.05$ .

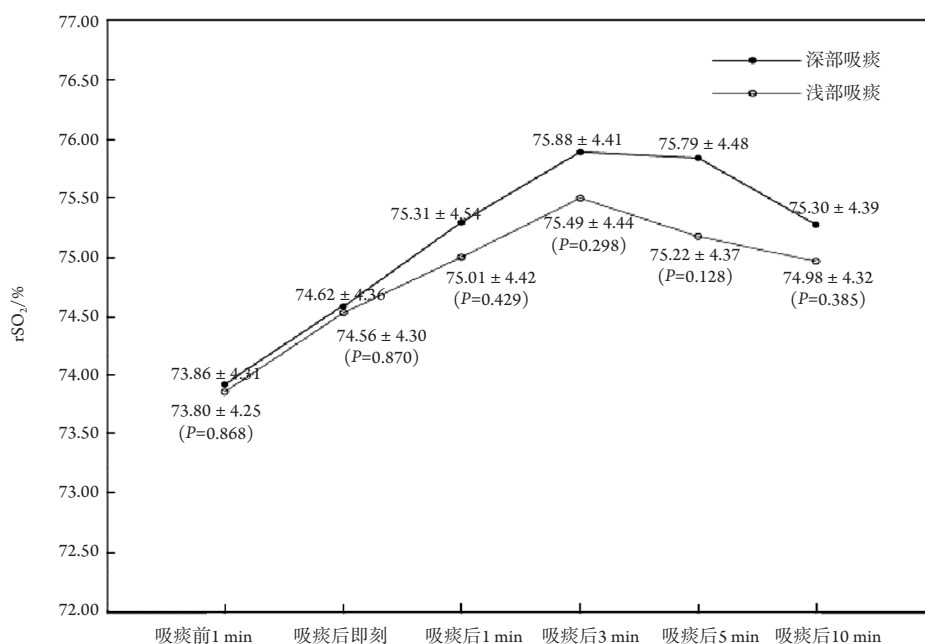


图2 深部与浅部吸痰患者不同时间点脑组织血氧饱和度变化曲线

Figure 2 Change curve of blood oxygen saturation in brain tissues at different time points in patients with deep and shallow sputum suction

表3 不同吸痰深度吸痰前后血压水平变化( $n=70$ )Table 3 Changes of blood pressure levels before and after sputum suction at different depths ( $n=70$ )

组别	吸痰次数	监测项目	吸痰前 1 min/mmHg	吸痰后 即刻/mmHg	吸痰后 1 min/mmHg	吸痰后 3 min/mmHg	吸痰后 5 min/mmHg	吸痰后 10 min/mmHg
深部吸痰	280	收缩压	146.28 ± 12.58	157.47 ± 11.89*	155.01 ± 12.89*	150.29 ± 12.88*	147.45 ± 10.45	143.69 ± 9.58*
		舒张压	86.28 ± 5.05	91.53 ± 6.01*	89.48 ± 6.28*	87.42 ± 5.11*	85.84 ± 5.18	84.85 ± 4.52*
		平均动脉压	106.33 ± 15.12	113.52 ± 15.47*	111.29 ± 14.85*	108.52 ± 14.85*	106.56 ± 14.88	104.75 ± 13.68*
浅部吸痰	280	收缩压	146.45 ± 13.80	152.92 ± 13.74*	151.58 ± 12.14*	148.11 ± 19.25	144.19 ± 12.42*	142.82 ± 12.49*
		舒张压	87.72 ± 8.08	90.24 ± 8.24*	88.24 ± 8.34*	86.48 ± 6.85	85.54 ± 6.47*	84.56 ± 5.17*
		平均动脉压	107.68 ± 14.28	111.15 ± 14.38*	109.56 ± 13.12*	106.79 ± 14.14	105.35 ± 10.85*	104.18 ± 11.26*

与吸痰前1 min比较, \* $P<0.05$ 。1 mmHg=0.133 kPa。

Compared with 1 min before suction, \* $P<0.05$ . 1 mmHg=0.133 kPa.

### 3 讨论

高血压脑出血患者通常存在意识障碍, 为确保患者呼吸道通畅, 应尽可能避免由于气道内分泌物堆积而造成的大量细菌繁殖<sup>[5-6]</sup>。有效清理患者气道分泌物是降低行气管切开、气管插管的患者肺部感染发生率的重要措施<sup>[7]</sup>。吸痰虽然可有效清除气道分泌物, 但对高血压脑出血患者实施吸痰操作可影响血压及颅内压, 最终可对其大脑造成二次损伤<sup>[8-10]</sup>。目前临床对于吸痰深度尚无统一论<sup>[11]</sup>。

氧是维持人体正常生命活动的重要元素, 机体主要由呼吸系统吸入氧气, 并经血液循环将其送到体内各组织器官, 因此, 血氧水平能够有效反映机体供氧及耗氧水平<sup>[12-13]</sup>。SpO<sub>2</sub>为目前临床反映脑组织氧合状况的重要指标, 高血压患者发生脑组织缺氧缺血可加重病情并诱发脑死亡<sup>[14]</sup>。本研究结果显示: 深部和浅部吸痰后即刻SpO<sub>2</sub>水平均低于吸痰前1 min, 吸痰后3、5、10 min的SpO<sub>2</sub>水平均高于吸痰前1 min。这表明通过吸痰能够促使患者SpO<sub>2</sub>水平在短时间内下降, 但吸痰一定时间后, 患者SpO<sub>2</sub>水平可恢复至吸痰前水平。吸痰操作会对患者SpO<sub>2</sub>水平造成一定的影响, 但吸痰可改善患者机体血氧水平<sup>[15-16]</sup>, 其原因在于, 吸痰会对患者呼吸道产生刺激, 且呼吸道分泌物的清除确保了患者呼吸道的通畅。rSO<sub>2</sub>直接反映患者脑组织氧合状况, 并能在患者头颅闭合的情况下进行实时动态监测, 对组织血流、氧化代谢等情况进行有效评估<sup>[17-18]</sup>。本研究结果显示深部和浅

部吸痰后即刻及吸痰后1、3、5、10 min的rSO<sub>2</sub>水平均高于吸痰前1 min, 表明吸痰不会对患者术后rSO<sub>2</sub>水平造成较大影响, 吸痰后rSO<sub>2</sub>水平上升与患者全身血氧及状态改善相关<sup>[19]</sup>。本研究结果显示深部与浅部吸痰相比吸痰前后各时间点SpO<sub>2</sub>和rSO<sub>2</sub>水平差异均无统计学意义, 表明深部和浅部吸痰对高血压脑出血患者的效果相当, 这主要与2种吸痰方式均可有效清除患者气道内分泌物, 从而确保气道通畅相关<sup>[20]</sup>。本研究结果显示: 深部吸痰与浅部吸痰于各时间点的血压差异并不明显, 仅仅在吸痰后即刻深部吸痰组收缩压高于浅部吸痰组, 而通过比较2种吸痰方式下患者的血压值升高情况, 发现吸痰后5 min内深部吸痰所引发的患者血压值升高更为明显。这表明深部吸痰对高血压脑出血术后患者血压水平影响较大, 其原因在于, 不同吸痰深度所引发的刺激程度不同, 在进行浅部吸痰时吸痰管不会对患者气道黏膜造成刺激, 仅仅在打开吸痰负压气流时会对患者产生刺激, 而深部吸痰会对患者气道黏膜产生直接刺激, 且实施深部吸痰时吸痰管与患者气道黏膜直接接触, 因此会引发咳嗽反射, 从而增加了血压上升幅度。本研究不足之处在于所选样本量较小, 且并未追踪患者的长期预后, 研究结论尚需后期开展合理的大样本、长期随访研究进行验证。

综上所述, 深部吸痰、浅部吸痰对高血压脑出血气管切开术患者的吸痰效果一致, 且对血氧饱和度的影响无明显差异, 临床建议实施浅部吸痰, 以减少不良反应的发生。

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