·临床研究·

术中局部脑氧饱和度水平与老年全身麻醉术后谵妄发生的关系

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【摘 要】 **目的** 探讨术中局部脑氧饱和度(rSO_2)的变化与老年患者全麻手术后发生谵妄的关系。**方法** 选择2017年1月至2018年1月内蒙古医科大学附属医院麻醉科收治的老年全麻脊柱手术患者76例。患者入室后持续监测rSO_2,并记录麻醉诱导前(T0)、气管插管后(T1)、手术开始时(T2)、手术开始后1 h(T3)、手术开始后2 h(T4)、术毕(T5)时的rSO_2、心率(HR)及平均动脉压(MAP)。以患者T0时的rSO_2值作为基线值,计算T0~T5的rSO_2平均值($\overline{rSO_2}$)、最小值(rSO_{2min})和较基线值下降的最大差值(ΔrSO_{2max})。采用意识紊乱测试法(CAM)对术后患者认知状态进行评估,并分为术后谵妄组(POD组,14例)和非术后谵妄组(NPOD组,62例),同时比较2组上述指标。采用SPSS 18.0软件对数据进行分析。组间比较采用t检验,组内比较采用重复测量的方差分析或两两比较。**结果** POD发生率为18.4%(14/76)。2组患者T0~T5的MAP及HR比较差异均无统计学意义($P>0.05$)。T0~T3的rSO_2在2组间比较无明显差异($P>0.05$);T4、T5时,相比NPOD组,POD组患者rSO_2值明显下降($P<0.05$)。与NPOD组比较,POD组患者ΔrSO_{2max}显著升高[(0.09±0.04)%和(0.05±0.02)%],$\overline{rSO_2}$显著降低[(73.29±1.69)%和(75.49±1.89)%],但rSO_{2min}[(65.00±3.40)%和(67.47±5.10)%]及基线值[(71.14±0.77)%和(70.95±0.89)%]比较差异无统计学意义($P>0.05$)。**结论** 术中rSO_2的降低与POD的发生有明显相关性,术中监测rSO_2可作为预测POD发生的辅助手段。

【关键词】 老年人;术后谵妄;脑氧饱和度
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Relationship between intraoperative level of cerebral oxygen saturation and postoperative delirium in the elderly undergoing general anesthesia during surgery

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【Abstract】 **Objective** To investigate the relationship between the changes of regional cerebral oxygen saturation (rSO_2) and postoperative delirium in the elderly after general anesthesia. **Methods** A total of 76 elderly patients receiving spinal surgery under general anesthesia in our hospital from January 2017 to January 2018 were enrolled in this study. After entering the operation room, the patients were monitored for rSO_2 continuously. rSO_2, heart rate (HR) and mean arterial pressure (MAP) were recorded before anesthesia induction (T0), after tracheal intubation (T1), at the beginning of (T2), in 1 h(T3) and 3 h(T4) after, and at the end of operation (T5). With the rSO_2 value at T0 as the baseline value, the mean ($\overline{rSO_2}$), minimum (rSO_{2min}) and maximum descendence (ΔrSO_{2max}) of rSO_2 from T0 to T5 were calculated. Consciousness disorder test (CAM) was applied for the cognitive status of postoperative patients, and they were divided into postoperative delirium group (POD group, $n=14$) and non-postoperative delirium group (NPOD group, $n=62$). SPSS statistics 18.0 was used to analyze the data. t test, the analysis of variance of repeated measurement or pairwise comparison was employed for comparison. **Results** The incidence of POD was 18.4%(14/76) in this study. There were no significant differences in MAP and HR at T0 to T5 between the 2 groups ($P>0.05$). Though no obvious differences were seen in rSO_2 at T0–T3 between the 2 groups ($P>0.05$), the value was significantly decreased in the POD group than the NPOD group at T4 and T5 ($P<0.05$). The POD group had significantly higher ΔrSO_{2max}[(0.09±0.04)% *vs* (0.05±0.02)%], and lower $\overline{rSO_2}$ [(73.29±1.69)% *vs* (75.49±1.89)%], but no obviously difference in rSO_{2min}[(65.00±3.40)% *vs* (67.47±5.10)%, $P>0.05$] and baseline [(71.14±0.77)% *vs* (70.95±0.89)%, $P>0.05$] when compared with the NPOD group. **Conclusion** There is a significant correlation between the decrease of intraoperative rSO_2 and occurrence of POD. The monitoring of rSO_2 during operation can be used as an auxiliary means to predict the occurrence.

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术后谵妄(postoperative delirium, POD)是一种急性精神混乱状态,通常在术后早期急性发作,病情波动,临床上以意识、思维、记忆、注意力、定向力、行为等的变化为特征[1]。POD极大地危害着老年人的健康,不仅增加住院时间和医疗费用,还增加术后其它并发症的发生率和死亡率[2]。据统计,年龄>65岁的患者POD发生率约为10%~70%,且发生POD的老年患者6个月内的死亡率高达25%[3]。目前,POD发病机制不明,有效预防其发生的方法也不多[4,5]。局部脑氧饱和度(regional cerebral oxygen saturation, rSO_2)变化被认为与POD的发生有一定关系。有报道称,术前rSO_2正常但术后发生谵妄的患者,其术中rSO_2下降程度较大[6]。由于POD发病率高、危害性大,早期诊断结合及时有效的处理可以减少其所造成的不良预后,加快患者病情恢复。本研究以老年全麻脊柱手术患者为对象,采用意识紊乱测试法(confusion assessment method, CAM)[7]对患者术后3 d内的认知状态进行评估,观察此类手术POD的发生率,并通过对术中rSO_2的持续监测,探讨其与POD的相关性,判断其能否作为发生POD的理想预测指标。

1 对象与方法

1.1 研究对象

选择2017年1月至2018年1月内蒙古医科大学附属医院麻醉科收治的老年全麻脊柱手术患者76例。根据术后是否发生谵妄分为POD组14例和非POD组62例。纳入标准:(1)行择期脊柱全麻手术,术前无精神、神经系统疾病史;(2)年龄≥65岁,体质量50~80 kg,美国麻醉医师协会(American Society of Anesthesiologists, ASA)Ⅱ级;(3)无酗酒及精神药物成瘾史,无严重肝、肾功能障碍;(4)无严重心脑血管病变。排除标准:(1)文盲或严重视力、听力障碍,无法与医师有效交流;(2)术前简易智力状态检查(Mini-mental State Examination, MMSE)量表<23分;(3)患有老年痴呆、心理疾病、帕金森氏病。

1.2 方法

所有患者均不使用术前药(如抗胆碱药物和镇静安定类药物等)。入室后常规监测生命体征,使用rSO_2检测仪(型号:FORESIGHT,美国CAS Medical System公司)持续监测rSO_2。麻醉诱导:静脉注入枸橼酸舒芬太尼1.0~1.5 μg/kg,依托咪酯0.2~0.3 mg/kg,罗库溴铵0.6~0.9 mg/kg。麻醉维持:静脉泵注异丙酚3~4 mg/(kg·h)、瑞芬太尼0.2~0.3 μg/(kg·h)。术中根据患者的生命体征变化和出血量调整输液量,必要时使用血管活性药物,维持术中血流动力学稳定,术中血压波动不超过基础值的30%。术毕带静脉自控镇痛泵返回病房。采用CAM诊断标准对患者术后3 d内的认知状态进行评估,具体标准如下:(1)急性起病,波动病程;(2)注意力不集中;(3)思维混乱;(4)意识改变。若同时符合上述诊断中的第1和第2项,并有3或4其中一项即可诊断为POD。

1.3 监测指标

患者入室后持续监测rSO_2,并记录麻醉诱导前(T0)、气管插管后(T1)、手术开始时(T2)、手术开始后1 h(T3)、手术开始后2 h(T4)、术毕(T5)6个时间段的rSO_2值,并记录对应时间段的心率(heart rate, HR)及平均动脉压(mean arterial pressure, MAP)。以患者T0时的rSO_2值作为基线值,并利用以上6个时间段rSO_2水平计算术中rSO_2的平均值($\overline{rSO}_2$)、术中rSO_2最小值(rSO_{2min})和rSO_2较基线值下降的最大差值(ΔrSO_{2max})。监测设备均为同一台设备测量,以减小测量差异。

1.4 统计学处理

采用SPSS 18.0软件对数据进行分析。计量资料以均数±标准差($\bar{x}\pm s$)表示,组间比较采用t检验,组内比较采用重复测量的方差分析或两两比较。$P<0.05$为差异具有统计学意义。

2 结 果

2.1 2组患者一般资料比较

与非POD组比较,POD组患者年龄[(69.79±4.82)和(69.47±4.02)岁]、性别构成[男/女,11/3和48/14]、术前MMSE评分[(27.21±1.63)和(26.74±1.48)分]、手术时间[(178.57±14.32)和(186.03±17.72) min]、术中失血量[(481.29±84.87)和(501.03±75.44) ml]均无明显变化,2组比较差异无统计学意义($P>0.05$)。

2.2 2组患者术中血流动力学指标和rSO_2水平比较

T0~T5各时间点2组患者MAP、HR比较,差异无统计学意义($P>0.05$)。与T0比较,2组患者

T1～T5 的 MAP 和 HR 亦均未发生明显变化，提示患者的血流动力学一直处于平稳状态。T0～T3 的 rSO_2 2 组间比较无明显差异（$P>0.05$）；T4、T5 时，相比 NPOD 组，POD 组患者 rSO_2 值明显下降（$P<0.05$）。NPOD 组 rSO_2 值在 T1～T4 时明显高于 T0，但 T5 时无明显差异；POD 组 rSO_2 值在 T1～T3 时明显高于 T0，而 T5 时较 T0 明显下降，差异有统计学意义（$P<0.05$；表 1）。

2.3 2 组患者 rSO_2 基线值、$\overline{rSO_2}$、rSO_{2min} 及 ΔrSO_{2max} 比较

与 NPOD 组比较，POD 组患者 ΔrSO_{2max} 显著升高，$\overline{rSO_2}$ 显著降低（$P<0.05$），但 rSO_{2min} 及基线值比较差异无统计学意义（$P>0.05$；表 2）。

3 讨 论

POD 是一种术后急性脑病综合症，发病原因目前尚不清楚，可能与脑部缺血再灌注损伤、血管内皮损伤[8]、神经炎症[9]、麻醉药物的作用[10,11]、麻醉方式[12]、术后疼痛、高龄[13]等有关。除此之外，老年脊柱手术患者术前、术后禁食时间过长（>20 h），特别是气管插管全麻行颈椎前路手术的患者，因术后出现咽部不适、吞咽困难，导致术后进食时间推迟从而发生低血糖；还有对于行颈椎手术的患者术后佩戴颈圈制动、安置导尿管等，这些都可能是发生 POD 的危险因素。本研究中 POD 的发生率为 18.4%，与国内一些学者的研究结果相近，表明老年脊柱手术 POD 临床发生率较高，应予以重视。本研究纳入的 2 组患者均为老年患者，均采用全麻方式，术前未使用任何抗胆碱能药物，且都进行了良好的术后镇痛，这就排除了年龄、麻醉方式和药物、疼痛等给结果可能带来的干扰。

有研究证实，术中 rSO_2 的变化可以反映大脑氧供需平衡和新陈代谢的变化，术中发生低 rSO_2 与术后早期认知功能低下密切相关[14,15]。Slater 等[16]研究表明，术中 rSO_2 低于 50%或较基础值下降 20%以上就会存在脑缺血的可能，患者神经系统的损伤增加，这在老年患者中尤为明显。本研究关注脑灌注对中枢神经系统以及认知功能的影响，以脑氧供氧耗的平衡为切入点，通过术中对 rSO_2 动态监测以明确脑氧代谢与 POD 之间的相关性。结果发现，POD 组患者 ΔrSO_{2max} 显著高于 NPOD 组，而 $\overline{rSO_2}$ 值显著低于 NPOD 组。同时 NPOD 组 rSO_2 值 T5 时较 T0

表 1 2 组患者术中不同时间血流动力学和 rSO_2 水平的比较

Table 1 Comparison of hemodynamics and rSO_2 levels between 2 groups at T0–T5 （$\bar{x}\pm s$）

Group	n	MAP（mmHg）					
		T0	T1	T2	T3	T4	T5
NPOD	62	85.8±4.0	79.5±4	83.2±3.3	81.0±3.4	81.3±2.7	87.2±3.7
POD	14	83.9±5.0	78.3±4.1	82.7±3.5	82.9±4.6	79.4±3.4	85.6±3.5
Group	n	HR（times/min）					
		T0	T1	T2	T3	T4	T5
NPOD	62	77.5±5.8	69.7±4.8	69.7±3.6	70.9±5.5	71.4±4.1	81.0±6.2
POD	14	75.2±4.3	65.2±3.3	68.0±2.7	67.9±3.2	69.4±2.1	79.9±3.9
Group	n	rSO_2（%）					
		T0	T1	T2	T3	T4	T5
NPOD	62	70.95±0.89	78.18±1.29*	79.03±0.77*	76.24±3.35*	74.05±6.05*	69.94±5.65
POD	14	71.14±0.77	78.86±0.77*	78.64±2.34*	74.21±4.93*	68.5±4.36#	66.21±4.1*#

MAP：mean arterial pressure；HR：heart rate；POD：postoperative delirium；rSO_2：regional cerebral oxygen saturation. 1 mmHg=0.133 kPa. Compared with T0，*$P<0.05$；compared with NPOD group，#$P<0.05$.

表 2 2 组患者 rSO_2 基线值、$\overline{rSO_2}$、rSO_{2min}、ΔrSO_{2max} 的比较

Table 2 Comparison of baseline rSO_2, $\overline{rSO_2}$, rSO_{2min} and ΔrSO_{2max} between 2 groups （%，$\bar{x}\pm s$）

Group	n	Baseline	$\overline{rSO_2}$	rSO_{2min}	ΔrSO_{2max}
NPOD	62	70.95±0.89	75.49±1.89	67.47±5.10	0.05±0.02
POD	14	71.14±0.77	73.29±1.69	65.00±3.40	0.09±0.04
P value		0.462	<0.001	0.090	0.003

POD：postoperative delirium；rSO_2：regional cerebral oxygen saturation；$\overline{rSO_2}$, rSO_{2min} and ΔrSO_{2max}：the mean, minimum, and maximum descendence of rSO_2.

无明显差异,但 POD 组 rSO_2 值 T5 时较 T0 明显下降($P<0.05$),这就表明 POD 组患者术中 rSO_2 下降,同时提示 POD 组患者可能存在脑血流低灌注和脑氧供需失衡,脑组织发生缺血缺氧,引起大脑能量供应不足,中枢神经递质释放减少,脑细胞间信息交换能力随神经细胞的损伤而下降,从而可能引发 POD,这与 Maldonado 等[17]的研究结果一致。可见,术中 rSO_2 的变化可以作为一个重要指标来预测 POD 的发生。本研究中,POD 组患者术中 rSO_2 在 T3、T4 时间段开始下降,在 T5 时更低,rSO_{2min} 出现在 T5 时间段。分析原因如下。首先,脊柱手术本身时间长、创伤大,术中机体处于持续应激状态,患者血中持续高水平的肾上腺素、去甲肾上腺素导致脑血流加速、耗氧量增加而使 rSO_2 下降;其次,外周炎性刺激使得中性粒细胞大量释放炎症因子,引起脑细胞水肿,加重脑缺氧;最后,老年患者合并基础疾病多,血管舒缩功能及自身调节能力下降,脑功能的代偿水平较低,脑细胞对缺氧的耐受力弱,术中脑氧平衡极易被打破,较为轻微的缺氧就有可能导致 rSO_2 下降。持续的脑耗氧量增加、脑水肿、对缺氧的耐受力减弱等都会随着手术时间的延长而进一步恶化,使得患者在接近术毕时刻的 rSO_2 值下降。除此之外,脊柱手术中控制性降压虽然可有效减少术野出血,为术者提供清晰的术野,但也可能是造成术中脑供血不足和脑缺氧的一个诱因。本研究中严格维持术中血压平稳,使血压降低的最大限度不超过基础值的 30%,在满足术者术野要求的同时,尽量避免因术中血压过低而导致 rSO_2 的降低。另外,有研究证明,rSO_2 可反应脑氧供和氧耗的改变,但脑氧代谢的变化与全身血流动力学波动不同步,脑氧供需失衡较全身氧供需失衡发生的更早、更快[18],对老年患者来说,脑细胞对缺氧的耐受力减弱,对缺氧刺激也会更敏感。

综上,POD 是老年患者术后常见的神经系统并发症,我们应给予足够的重视。术中 rSO_2 的变化可为早期脑氧供需平衡和脑组织血流量的变化以及脑缺血、缺氧的情况作出判断,及时调整麻醉计划和麻醉管理,并可预测 POD 的发生。总之,术中应避免发生长时间的低 rSO_2,维持脑氧供和氧耗的平衡,从而降低 POD 发生率,改善患者预后。

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