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不同浓度右美托咪定对低血红蛋白全麻患者脑氧饱和度的影响*

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摘要 目的:探讨不同浓度右美托咪定(Dex)对低血红蛋白全麻患者脑氧饱和度(rSO₂)的影响。**方法:**选取择期全麻开腹妇科手术、血红蛋白在 8~9 g/dl 的女性患者 60 例,根据不同浓度右美托咪定随机分为 D1(0.1 μg·kg⁻¹·h⁻¹)、D2(0.3 μg·kg⁻¹·h⁻¹)、D3(0.5 μg·kg⁻¹·h⁻¹)以及 C 组(等量 0.9%生理盐水组),每组 15 例。D1~D3 组患者入室后于麻醉开始前均给予 0.5 μg·kg⁻¹ 负荷剂量右美托咪定于 15 min 内泵入。四组麻醉诱导后,均行七氟醚复合瑞芬太尼静吸复合麻醉维持,D1~D3 组泵入相应浓度剂量的右美托咪定,C 组泵入等量的生理盐水,直至手术结束前 40 min 停止泵入。在诱导前开始记录患者以下变量基线值:平均动脉压(MAP)、心率(HR)、血氧饱和度(SpO₂)、脑氧饱和度(rSO₂)、脑电双频指数(BIS)、以及腋温(T)。并在术中相对平稳期同样记录以上变量数值以及呼吸末二氧化碳浓度(P_{ET}CO₂),每 3 min 记录一次,共记录 30 min。**结果:**四组患者入室后脑氧饱和度、平均动脉压、心率、指脉氧饱和度和腋温组间比较差异无统计学意义(P>0.05)。与 D1 组比较,D2 组脑氧饱和度较高;与 D2 组比较,D3 组脑氧饱和度较高,差异有统计学意义(P<0.05)。在一定剂量范围内应用右美托咪定,可使低血红蛋白患者术中脑氧饱和度随泵入右美托咪定剂量的增加而增加,并且这一关系具有线性相关性(P<0.05,相关系数 r=0.9999)。**结论:**在一定剂量范围内应用右美托咪定可使低血红蛋白患者术中脑氧饱和度随应用右美托咪定剂量增加而增加,对于改善患者预后起着积极作用。

关键词:脑氧饱和度;右美托咪定;血红蛋白;近红外光谱技术

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Effect of Different Concentrations of Dexmedetomidine on the Cerebral Oxygen Saturation of Low Hemoglobin Patients under General Anesthesia*

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ABSTRACT Objective: To evaluate the effect of applying different concentrations of dexmedetomidine (Dex) to low hemoglobin patients on cerebral oxygen saturation (rSO₂) under general anesthesia. **Methods:** Select sixty female patients with hemoglobin concentration between 8 to 9 g/dl. They are all scheduled for elective intraabdomenally gynecologic operation, and were randomly divided into four groups according to the different concentrations of dexmedetomidine: D1 (0.1 μg·kg⁻¹·h⁻¹), D2 (0.3 μg·kg⁻¹·h⁻¹), D3 (0.5 μg·kg⁻¹·h⁻¹) and group C (given the equivalent amount of 0.9 % saline), each group is composed of 15 patients. Before anesthesia induction, D1~D3 groups were all given 0.5 μg/kg loading dose of Dex, which was required to be pumped within 15 min for each patient. After anesthesia induction, four groups all underwent sevoflurane and remifentanyl intravenous-inhalation combined anesthesia, D1~D3 group were given the corresponding concentration of dexmedetomidine, whereas group C given equivalent amount of saline. All the injection was stopped 40 min before the end of surgery. Record the patients' following baseline variables before induction: mean arterial pressure (MAP), heart rate (HR), oxygen saturation (SpO₂), cerebral oxygen saturation (rSO₂), bispectral index(BIS), and axillary temperature(T). Select a relatively stable period during surgery and record the variables mentioned above as well as end-tidal pressure of carbon dioxide (P_{ET}CO₂) at every 3 min for 30 min. **Results:** There was no significant difference in the cerebral oxygen saturation, mean arterial pressure, heart rate, pulse oxygen saturation, and axillary temperature between the four groups(P>0.05). Compared with group D1, cerebral oxygen saturation was higher in group D2. Compared with group D2, cerebral oxygen saturation was higher in group D3 (P<0.05). When increasing the application of dexmedetomidine within a certain dose range in patients of low hemoglobin can increase the cerebral oxygen saturation, and this relationship has a linear correlation (P<0.05), with a correlation coefficient of r=0.9999, and a linear regression equation of y=12.45x+56.005. **Conclusion:** Applying dexmedetomidine at a certain dose range, can increase low hemoglobin patients cerebral oxy-

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gen saturation as the dexmedetomidine dose increases.

Key words: Cerebral oxygen saturation; Dexmedetomidine; Hemoglobin concentration; Near infrared spectroscopy

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前言

脑氧饱和度(rSO_2)是通过近红外光谱技术测得的可用于评价术中局部脑组织的氧供需平衡指标,对评估患者预后也具有重要参考价值^[1]。然而,脑氧饱和度受诸多因素影响,包括患者年龄、血红蛋白(Hb)、动脉血氧饱和度、呼吸末二氧化碳浓度、脑氧饱和度探头放置的位置以及患者体位等^[2-5]。研究表明血红蛋白的降低会导致脑氧饱和度下降。

右美托咪定是一种新型 α_2 -肾上腺素能受体激动剂,具有抗交感、稳定脑血流、抗炎因子、脑保护等重要作用。有研究显示在动物模型中应用右美托咪定可以改善低血红蛋白小鼠的脑血流,降低脑氧耗。但右美托咪定对于低血红蛋白患者脑氧饱和度的影响目前尚无定论。因此,本研究主要探讨了不同剂量的右美托咪定对低血红蛋白患者脑氧饱和度的影响,以期对右美托咪定的临床应用提供参考。

1 资料与方法

1.1 一般资料

本研究在中国医科大学附属盛京医院手术室内完成,并且已经通过中国医科大学附属盛京医院医学伦理委员会批准。术前取得患者同意,并与患者签署知情同意书。选取在我院行择期妇科开腹手术全麻患者,血红蛋白(Hb)8~9 g/dl的女性患者60例,ASA分级I~II级,年龄45~65岁、身高160~170 cm、体重50~80 kg。排除术前应用神经精神类药物者,既往有呼吸系统、循环系统、中枢神经系统疾病或脑肿瘤的患者,ASA III级、基线脉搏血氧饱和度<98%、对BIS监测仪以及脑氧饱和度监测仪存在低反应性、并前额区面积<6.5 cm²患者,血流动力学不稳定以及术中平均动脉压与基线比较浮动大于 $\pm 25\%$,持续3 min的患者,术毕测得患者血红蛋白与术前比较相差大于 ± 0.5 g/dL的患者。采用计算机随机数字表法将所有患者随机分成D1(0.1 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$)、D2(0.3 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$)、D3(0.5 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$)以及C组(等量0.9%生理盐水组)4个组,每组15例。

1.2 方法

1.2.1 麻醉前准备 所有患者进入手术室前均不给予术前用药,并且禁食8小时、禁饮4小时。四组患者入室后常规连接心电图、血压、脉搏血氧饱和度,连接BIS监测仪器以及脑氧饱和度检测仪。在诱导之前,在病人呼吸室内空气状态下记录一下以下数值的基线值:平均动脉压(MAP)、心率(HR)、血氧饱和度(SpO_2)、脑氧饱和度(rSO_2)以及腋温(T),每分钟记录变量值、记录5 min。并且记录患者一般信息:年龄、体重、身高、头围。以后常规面罩吸氧,心电监护。用18G静脉穿刺针建立上肢静脉通路,以及22G动脉穿刺置管建立上肢动脉通路,并采血气测患者血红蛋白。以80滴/min的速度输注乳酸林格试液,在麻醉诱导前D1~D3组均给予右美托咪定(批号:14082932,江苏恒瑞医药股份有限公司),配成4 $\mu\text{g}/\text{mL}$,以负荷剂量0.5 $\mu\text{g}/\text{kg}$,

15 min内静脉泵入。C组给予等容量的0.9%生理盐水。

1.2.2 麻醉实施方法 给予患者完全预充氧以后,四组患者均给予芬太尼(批号:1141102,宜昌人福药业有限公司)2 $\mu\text{g}/\text{kg}$,丙泊酚(批号:kv32, Cordem Pharma S.P.A.)2.5 mg/kg 行麻醉诱导。待睫毛反射消失后静推顺式阿曲库铵(批号:14121817,江苏恒瑞医药股份有限公司)0.2 mg/kg 。所有情况下,待肌松完全及循环稳定后,行插入喉罩,并固定。给予机械通气,参数为:潮气量7 mL/kg ,呼吸频率12次/min,吸呼比1:2,呼吸末正压通气调到零,氧/空气混合(1:1)。之后调整分钟通气量维持 $P_{\text{ET}}\text{CO}_2$ 在35~40 mmHg之间。麻醉维持阶段在麻醉师的指导下,采用七氟醚吸入麻醉维持,并静脉泵入瑞芬太尼(批号:6141010,宜昌人福药业有限公司)剂量为0.09 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ 。在麻醉诱导后至手术结束期间,四组吸入麻醉药控制在呼气末浓度0.9~1.1 MAC,并监测BIS值,使四组在手术过程中BIS值均为45~55之间,以保证相同的麻醉深度。于麻醉诱导后,D1~D3组分别泵入,配成4 $\mu\text{g}/\text{mL}$,相应浓度的右美托咪定直到手术结束前40 min停药,C组持续泵入等量的0.9%生理盐水直到术前40 min。如果给药期间血压低于基础值25%,则给予麻黄素(批号:140505-1,东北制药)5 mg静注,或心率低于50次/分,则给予阿托品(批号:1409262,河南润弘制药股份有限公司)0.3 mg静注。根据手术情况间断追加顺式阿曲库铵,维持血流动力学稳定,保持平均动脉压(MAP)波动在基础值的25%以内,维持术中血氧饱和度(SpO_2)98%。于手术结束即刻采血气,测患者血红蛋白。选取术中腹膜切开后至手术结束前40分钟期间相对平稳麻醉期间每3 min记录,记录30 min;记录包括:平均动脉压(MAP)、心率(HR)、脉搏血氧饱和度(SpO_2)、呼吸末二氧化碳分压($P_{\text{ET}}\text{CO}_2$)、脑氧饱和度(rSO_2)、脑电双频指数(BIS)、以及腋温(T)。每位患者,对于每个观察变量分别在术中平稳期共记录10个时间点,并统计这10个时间点的平均数值,即可得出每位患者在术中相对平稳期的各参数的平均值。术中给药和数据收集均由另外一名麻醉师完成。

1.3 统计学处理

采用SPSS19.0统计学软件进行分析,计量资料以均数 $\pm$ 标准差($\bar{x} \pm s$)表示,多组间比较采用单因素方差分析,两组间比较采用SNK-q检验,计数资料比较采用 χ^2 检验,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 四组患者基本临床资料的比较

如表1所示,四组患者性别、年龄、体重、身高、头围组间比较差异均无统计学意义($P>0.05$)。

2.2 四组患者入室后监测指标的比较

如表2所示,四组患者入室后脑氧饱和度、平均动脉压、心率、指脉氧饱和度、腋温组间比较差异无统计学意义($P>0.05$)。

表 1 四组患者基本临床资料的比较(n=15, $\bar{x} \pm s$)

Table 1 Comparison of the general information between the four groups of patients

Group	C	D1	D2	D3
Gender(F)	F(15)	F(15)	F(15)	F(15)
Age(age)	54 $\pm$ 10	56 $\pm$ 7	55 $\pm$ 9	52 $\pm$ 9
Weigh(Kg)	66 $\pm$ 14	60 $\pm$ 12	64 $\pm$ 13	68 $\pm$ 13
Hight(Cm)	165 $\pm$ 4.1	163 $\pm$ 2.7	164 $\pm$ 3.7	166 $\pm$ 4.2
Head circumference (Cm)	55.8 $\pm$ 1.21	55.27 $\pm$ 1.09	56.13 $\pm$ 1.60	55.13 $\pm$ 1.19

Note: There was no statistical significance between the various data groups(P>0.05).

表 2 四组患者入室后检测指标的比较(n=15, $\bar{x} \pm s$)

Table 2 Comparison of the indexes after entering the operation room between the four groups of patients

Index	C	D1	D2	D3
rSO ₂ (%)	62.32 $\pm$ 2.29	63.02 $\pm$ 1.96	62.37 $\pm$ 2.78	63.76 $\pm$ 1.62
BIS	93.35 $\pm$ 4.26	96.12 $\pm$ 4.64	95.01 $\pm$ 3.36	95.37 $\pm$ 4.23
MAP(mmHg)	89.87 $\pm$ 8.63	91.63 $\pm$ 9.89	88.42 $\pm$ 7.48	93.74 $\pm$ 8.35
HR(次/min)	75.23 $\pm$ 8.96	78.27 $\pm$ 6.61	73.49 $\pm$ 8.33	76.46 $\pm$ 8.73
SpO ₂ (%)	99.36 $\pm$ 0.51	99.54 $\pm$ 0.36	99.42 $\pm$ 0.46	99.31 $\pm$ 0.41
Axillary temperature(°C)	36.2 $\pm$ 0.46	36.4 $\pm$ 0.42	36.1 $\pm$ 0.55	36.3 $\pm$ 0.39

Note: There was no statistical significance between the various data groups(P>0.05).

2.3 四组术中相对平稳期监测指标比较

在术中相对平稳期,与C组比较,D1~D3组心率较低,D1组脑氧饱和度(rSO₂)较高;与D1组比较,D2组脑氧饱和度较高;与D2组比较,D3组脑氧饱和度较高,差异有统计学意义(P<0.05),如表3。在术中相对平稳期,四组患者,脑电双频指

数、平均动脉压、呼吸末二氧化碳浓度、指脉氧饱和度、腋温组间比较差异均无统计学意义(P>0.05),如表3。在一定剂量范围内应用右美托咪定,低血红蛋白患者术中脑氧饱和度随泵入右美托咪定剂量的增加而增加,呈显著相关性(P<0.05)。

表 3 术中平稳期各组指标比较(n=15, $\bar{x} \pm s$)

Table 3 Comparison of the index during the stable period of the operation

	C	D1	D2	D3
rSO ₂ (%)	55.23 $\pm$ 1.24	57.23 $\pm$ 2.11 ^a	59.78 $\pm$ 1.83 ^{ab}	62.21 $\pm$ 2.17 ^{abc}
BIS	51.75 $\pm$ 3.34	48.12 $\pm$ 5.56	52.01 $\pm$ 5.24	51.36 $\pm$ 3.56
MAP(mmHg)	86.60 $\pm$ 9.26	84.87 $\pm$ 11.56	81.27 $\pm$ 8.61	79.30 $\pm$ 10.43
HR(次/min)	72.04 $\pm$ 9.12	64.29 $\pm$ 6.26 ^a	62.78 $\pm$ 8.18 ^a	59.12 $\pm$ 5.81 ^a
P _{ET} -CO ₂ (mmHg)	38.47 $\pm$ 2.46	37.38 $\pm$ 2.89	38.31 $\pm$ 2.52	36.67 $\pm$ 3.86
SpO ₂ (%)	99.33 $\pm$ 0.46	99.45 $\pm$ 0.32	99.23 $\pm$ 0.41	99.26 $\pm$ 0.35
Axillary temperature(°C)	36.32 $\pm$ 0.53	36.27 $\pm$ 0.56	36.13 $\pm$ 0.39	36.35 $\pm$ 0.46

Note: Compared with Group C, ^aP<0.05; Compared with Group D1, ^bP<0.05; Compared with Group D2, ^cP<0.05.

3 讨论

脑氧饱和度监测能够直观反映脑部氧供需平衡变化^[9],具有连续监测、无创、灵敏、操作简单、减少术后并发症等优点^[7-9]。研究表明脑氧饱和度小于55%提示脑灌注压不充分^[10],脑氧饱和度均值在64%的患者术后并发症相比于58%会明显增加^[11]。因此,术中检测脑氧饱和度非常必要,目前已成为诸多国家术中临床常规监测指标之一^[11,12]。虽然rSO₂的临床应用广泛、不受温度和搏动血流的影响等诸多优点,但研究显示在腹腔镜手术

中,由于气腹的建立以及头低脚高位的影响会使脑氧饱和度升高。因此,在本实验中,我们选择术式为开腹妇科手术排除干扰因素,以获得实验的准确性。

右美托咪定是一种高选择性 α_2 受体激动剂,能够抑制交感神经兴奋,产生镇静、镇痛和抗焦虑^[13]、降低颅内压、维持血流动力学稳定的作用,同时也有稳定脑血流以及脑保护作用^[14-16]。由于右美托咪定对于血流动力学影响与剂量相关^[16],因此本研究设计术中泵入三组不同浓度右美托咪定。术中实时监测七氟醚呼末浓度、并控制七氟醚平均呼末浓度四组均为1.0 MAC,

排除不同吸入麻醉药浓度对实验造成干扰。右美托咪定还具有降血压、降心率作用,但本实验结果显示右美托咪定降心率作用更加明显,D1、D2、D3组心率均低于C组,并且差异具有统计学意义,而平均动脉压组间比较没有统计学意义。D1组的脑氧饱和度高于C组,D2组高于D1组以及D3组高于D2组,说明一定剂量范围内应用右美托咪定,可使低血红蛋白患者术中脑氧饱和度随泵入右美托咪定剂量的增加而增加。已经有研究证明血红蛋白和脑氧饱和度具有正相关关系^[2]。最近有研究显示在小鼠动物模型中,应用右美托咪定能够防止在出血状态下脑血流减少多于氧耗,维持脑氧供需平衡^[20],这与本研究发现一致,应用右美托咪定组的脑氧饱和度均高于对照组,并且脑氧饱和度随右美托咪定应用剂量增加而增加。Drummond JC等研究也发现右美托咪定对于脑血流的影响存在剂量相关性^[21]。

另有离体研究显示刺激 α_2 肾上腺受体能够扩张鼠的大脑中动脉^[22]。由于右美托咪定在特定的状态下可能也具有扩张脑血管的作用^[22],所以我们推测在血红蛋白减低情况下,右美托咪定可以防止脑血流和氧耗在出血时进一步减少的原因可能也与脑血管阻力的降低相关。而由于本研究并没有测定脑血流以及氧耗的变化,因此其中的具体机制有待于进一步研究。

本研究中,我们尽可能控制麻醉深度、呼吸末二氧化碳浓度恒定^[23],患者体位^[24]及脑氧饱和度探头位置恒定^[25],最大限度减少误差,保证实验精准。本研究结果表明右美托咪定能够提高低血红蛋白患者脑氧饱和度,并且在一定剂量范围内应用右美托咪定可使低血红蛋白患者术中脑氧饱和度随应用右美托咪定剂量增加而增加,对于改善患者预后起着积极作用。

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