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经皮穴位电刺激对甲状腺手术后围拔管期应激反应的影响*

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摘要 目的:观察经皮穴位电刺激对行甲状腺手术的患者全麻围拔管期应激反应的影响。**方法:**选择择期行甲状腺手术的患者 60 例,随机分为经皮穴位电刺激(T)组和假电刺激(C)组,T 组麻醉诱导前 30 分钟给予电刺激,C 组患者仅将电极片贴附在相同穴位但不给予电刺激。记录两组在入室(T0)、手术结束时(T1)、拔管后即刻(T2)、拔管后 5 min(T3)、拔管后 10 min(T4)的血压(NIBP)、平均动脉压(MAP)、心率(HR)以及静脉血中的肾上腺素(E)、去甲肾上腺素(NE)、皮质醇(Cor)的浓度;记录两组的拔管质量评分以及 Ricker 镇静-躁动评分。**结果:**T 组在 T2~T4 时的 NIBP、MAP、HR 以及 E、NE、Cor 的浓度均较 C 组显著降低($P<0.05$);与 C 组比较,T 组的拔管质量评分以及 Ricker 镇静-躁动评分降低($P<0.05$)。**结论:**经皮穴位电刺激能够减轻行甲状腺手术患者全麻围拔管期的应激反应,有利于维持血流动力学稳定。

关键词:经皮穴位电刺激;全麻拔管;应激反应;甲状腺手术

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Effect of Transcutaneous Electrical Acupoint Stimulation on Stress Response during Extubation of General Anesthesia after Thyroidectomy*

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ABSTRACT Objective: To investigate the effects of transcutaneous electrical acupoint stimulation (TEAS) on stress response during extubation of general anesthesia in patients undergoing thyroidectomy. **Methods:** Sixty patients, ASA I~II, undergoing thyroidectomy under general anesthesia were randomly divided into 2 groups ($n=30$ each) using a random number table: transcutaneous electrical acupoint stimulation group (T group) and Sham stimulation group (C group). 30 mins prior to the induction of anesthesia, patients in T group were given electrical stimulation, patients in C group had the electrodes applied, but received no stimulation. Baseline (T0), at the end of operation (T1), immediately after extubation (T2), and at 5, 10 min after extubation (T3, T4) noninvasive arterial blood pressure (NIBP), mean arterial pressure (MAP) and heart rate (HR) were recorded. Blood samples were taken from the vein artery at T0~T4 to record the concentration of Epinephrine (E), Norepinephrine (NE) and Cortisone (Cor). The extubation quality score, Ricker sedation-agitation scale, were also recorded and analyzed. **Results:** Compared with the baseline value at T0, NIBP, MAP, HR were significantly increased at T2~T4 in both groups ($P<0.05$); The NIBP, MAP, HR and concentrations of E, NE, Cor in T group were lower than those in C group at T2~T4 ($P<0.05$); Compared with C group, the extubation quality score and the Ricker sedation-agitation scale was lower ($P<0.05$). **Conclusions:** Transcutaneous electrical acupoint stimulation could restrain the stress response during extubation of general anesthesia in patients undergoing thyroidectomy, and be conducive to maintain the hemodynamics stability.

Key words: Transcutaneous electrical acupoint stimulation (TEAS); Extubation of general anesthesia; Stress response; Thyroidectomy

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前言

在全麻围拔管期由于气管导管等来自外界的各种刺激,患者可出现剧烈呛咳,血压升高,心率加快等应激反应,严重者还可导致呼吸心跳骤停,所以全麻拔管是一个极其危险的过程^[1,2]。尤其对于行甲状腺手术的患者,剧烈的呛咳及躁动还可导致手术结扎缝线脱落,手术区域出血形成血肿致患者窒息。因此,寻找一种安全有效的方法帮助患者平稳的度过围拔管期是一项亟需解决的问题。经皮穴位电刺激作为一种辅助麻醉方式越来越

得到广泛的重视,其以特定的频率和波型刺激相关穴位后,可引起机体释放某些物质,从而产生一定的作用^[3-5],本研究在麻醉诱导前 30 min 将经皮穴位电刺激应用于行甲状腺手术的全麻患者,观察其对拔管期间应激反应的影响以及其发生机制,以期为临床应用提供理论依据。

1 材料与方法

1.1 纳入及排除标准

纳入标准:本研究已获得中国医科大学附属盛京医院伦理

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委员会同意,并与患者签署研究知情同意书。选择择期行甲状腺手术的患者 60 例,年龄 30~70 岁,美国麻醉医师学会(American Society of Anesthesiology, ASA)分级为 I 或 II 级。

排除标准:有严重的心、肺、脑、肝、肾疾病,糖尿病或精神心理疾病不能正常合作;电刺激部位有感染;曾经接受过电针或者经皮穴位电刺激治疗,规律服用镇静或镇痛药。

1.2 一般材料

采用随机数字表法将 60 例行甲状腺手术的患者随机分为经皮穴位电刺激(T)组和假电刺激(C)组,每组 30 例。两组患者的年龄、性别、体重(kg)、手术时间(min)、麻醉时间(min)差异均无统计学意义(表 1)。

1.3 麻醉方法

患者入室后开放静脉通路,记录两组患者入室后麻醉诱导前的血压(noninvasive arterial blood pressure, NIBP),平均动脉压(mean arterial pressure, MAP),心率(heart rate, HR),脉搏血氧饱和度(pulse oximetry, SpO₂),脑电双频谱指数(bispectral index, BIS)。在麻醉诱导前 30 min,用华佗牌 SD-II 型电子诊疗仪给予经皮穴位电刺激(T)组患者电刺激,刺激穴位为双侧的合谷(LI4)、内关(PC6)、列缺(LU7)、尺泽穴(LU5),刺激频率为 2/100 Hz 的疏密波;刺激强度从 1 mA 逐渐增大,调至患者能耐受的最大刺激强度,一般为 6-15 mA, C 组患者仅将电极片贴附于相同的穴位但不给予电刺激。两组均静脉给予丙泊酚 2 mg/kg、舒芬太尼 0.3 g/kg、罗库溴铵 1 mg/kg 进行麻醉诱导,达到气管插管条件后经口明视进行气管内插管,连接麻醉机控制呼吸,呼吸频率 12~16 次/分,潮气量 6~8 mL/kg,调整呼吸参数维持呼吸末二氧化碳浓度(pressure of end-tidal carbon dioxide, P_{ET}CO₂)在 35-45 mmHg。术中采用静吸复合全麻的方式进行麻醉维持,持续吸入 2 Vol %七氟醚混合 50 %的笑气,氧气的流量为 2 mL/min,静脉泵注瑞芬太尼,术中根据 BIS 值以及血流动力学的变化调整七氟醚的吸入浓度以及瑞芬太尼的泵注速度,维持 BIS 值在正常范围内。在手术结束前的 5 min 停止药物泵注和电刺激。待患者意识清醒,且对指令有反应,自主呼吸、咳嗽反射、吞咽反射等恢复后拔除气管导管,将患者送至麻醉术后苏醒室(Postanesthesia care unit, PACU)。

1.4 观察指标

观察两组患者在入室(T0)、手术结束时(T1),拔管后立即(T2),拔管后 5 min(T3),拔管后 10 min(T4)的血压(Noninvasive blood pressure, NIBP),平均动脉压(Mean arterial pressure, MAP),心率(Heart rate, HR),并抽取 T0~T4 时的静脉血,测定静脉血中的肾上腺素(Epinephrine, E)、去甲肾上腺素(Norepinephrine, NE)、皮质醇(Cortisone, Cor)浓度;记录两组的拔管质量评分^[6](1 分,没有咳嗽;2 分,轻微咳嗽 1~2 次;3 分,中度咳嗽 3~4 次;4 分,重咳嗽 5~10 次或屏气;5 分,剧烈咳嗽,咳嗽大于 10 次或喉痉挛)和 Ricker 镇静-躁动评分^[7](7 分:危险躁动,试图拔除各种导管,在床上辗转挣扎;6 分:非常躁动,需要保护性束缚并反复语言提示劝阻;5 分:躁动焦虑或身体躁动,经言语提示劝阻可安静;4 分:安静合作,容易唤醒,服从指令;3 分:镇静嗜睡,语言刺激或轻轻摇动可唤醒并能服从简单指令;2 分:非常镇静,对躯体刺激有反应,不能服从指令;1 分:不能唤醒,对恶性刺激无或仅有轻微反应,不能服从指令)。

1.5 统计学方法

用 SPSS 16.0 统计软件进行数据处理与分析,计量资料以($\bar{x} \pm s$)表示,两组间比较采用独立样本 t 检验,重复测量的数据采用重复测量数据的方差分析,以 P<0.05 为差异有统计学意义。

2 结果

2.1 两组各时间点 NIBP、MAP、HR 的比较

如表 2 所示,与本组 T0 比较,两组在 T2~T4 时的 NIBP、MAP、HR 升高;与 C 组比较, T 组在 T2~T4 时的 NIBP、MAP、HR 下降,差异有统计学意义(P<0.05)。

2.2 两组各时间点静脉血中 E、NE、Cor 浓度的比较

如表 3 所示,与本组 T0 比较,两组在 T2~T4 时的静脉血中的 E、NE、Cor 的浓度升高;与 C 组比较, T 组在 T2~T4 时的静脉血中的 E、NE、Cor 的浓度降低,差异有统计学意义(P<0.05)。

2.3 两组拔管质量评分、Ricker 镇静-躁动评分的比较

如表 4 所示,与 C 组比较, T 组的拔管质量评分以及 Ricker 镇静-躁动评分降低,差异有统计学意义(P<0.05)。

表 1 两组一般情况比较($\bar{x} \pm s$)

Table 1 Comparison of Patients, characteristics and operational details($\bar{x} \pm s$)

Groups	Amount (n)	Gender (M/F)	Age (yr)	Weight (kg)	Operation Time (min)	Anesthesia Time (min)
T	30	13/17	48± 6.1	59.4± 3.2	98.0± 13.6	107± 14.2
C	30	12/18	51± 6.2	58.9± 3.8	96.0± 15.5	104± 13.9

3 讨论

经皮穴位电刺激(transcutaneous electrical acupoint stimulation, TEAS)是将欧美国家的经皮穴位电神经刺激疗法(transcutaneous electrical nerve stimulation, TENS)与针刺穴位相结合,通过贴附于皮肤上的电极片将不同频率的脉冲电流输入人体从而治疗某些疾病的方法。其相对于传统的针刺疗法,不仅创伤小,患者易于接受,而且还可以避免针刺的给患者带来的疼痛和恐惧。有研究表明经皮穴位电刺激与传统的针刺疗法对同

一脑功能区产生相似的调节作用,且两者之间的镇痛效果也无显著差异^[8],因此,经皮穴位电刺激作为一种安全有效的辅助麻醉方式的应用越来越广泛。

合谷穴属手阳明大肠经,刺激合谷穴可以产生一定的镇痛和镇静的作用,且针刺合谷联合其他穴位能够减轻肺叶切除术患者阿片类药物的用量^[9];内关穴属于手厥阴心包经,一项随机对照研究证实刺激内关穴能够减轻行开颅术的患者术后恶心呕吐的发生率^[10];列缺穴为手太阴肺经穴,具有通络止痛,宣肺利咽的功效,有研究证实列缺穴具有一定的脑损伤保护作用

表 2 两组各时间点 NIBP, MAP, HR 的比较($\bar{x} \pm s$)

Table 2 Comparison of hemodynamic parameters at different time points ($\bar{x} \pm s$)

Indexes	Groups	Amount(n)	T0	T1	T2	T3	T4
NIBP (mmHg)	T	30	112.6 $\pm$ 12.0	109.1 $\pm$ 10.3	126.8 $\pm$ 13.0 ^{*#}	123.0 $\pm$ 14.9 ^{*#}	119.9 $\pm$ 15.4 ^{*#}
	C	30	113.8 $\pm$ 12.8	112.9 $\pm$ 10.4	135.6 $\pm$ 14.5 [#]	134.4 $\pm$ 15.9 [#]	131.6 $\pm$ 16.4 [#]
MAP (mmHg)	T	30	81.4 $\pm$ 9.7	75.8 $\pm$ 8.1	98.0 $\pm$ 10.3 ^{*#}	97.5 $\pm$ 11.5 ^{*#}	92.9 $\pm$ 10.0 ^{*#}
	C	30	83.9 $\pm$ 10.7	81.1 $\pm$ 10.6	107.5 $\pm$ 12.0 [#]	105.3 $\pm$ 12.0 [#]	102.6 $\pm$ 14.7 [#]
HR (beats/min)	T	30	72.3 $\pm$ 6.9	64.6 $\pm$ 5.3	83.6 $\pm$ 8.6 [#]	80.9 $\pm$ 6.4 [#]	78.6 $\pm$ 7.2
	C	30	71.0 $\pm$ 8.3	66.7 $\pm$ 7.7	90.3 $\pm$ 9.2 [#]	88.6 $\pm$ 8.0 [#]	84.9 $\pm$ 7.3

Note: * P<0.05 compared with group C; #P < 0.05 compared with T0.

表 3 两组各时间点静脉血中 E, NE, Cor 浓度的比较($\bar{x} \pm s$)

Table 3 Comparison of plasma concentrations of catecholamines at different time points ($\bar{x} \pm s$)

Indexes	Groups	Amount(n)	T0	T1	T2	T3	T4
E (pg/mL)	T	30	17.7 $\pm$ 4.1	21.7 $\pm$ 6.4	30.7 $\pm$ 5.1 ^{*#}	27.5 $\pm$ 6.5 ^{*#}	25.6 $\pm$ 6.4 ^{*#}
	C	30	18.0 $\pm$ 4.0	23.9 $\pm$ 5.0	36.5 $\pm$ 6.4 [#]	35.2 $\pm$ 7.0 [#]	31.7 $\pm$ 6.6 [#]
NE (pg/mL)	T	30	333.2 $\pm$ 104.1	352.4 $\pm$ 91.6	384.8 $\pm$ 109.6 ^{*#}	375.6 $\pm$ 99.0 ^{*#}	361.6 $\pm$ 102.8 ^{*#}
	C	30	338.6 $\pm$ 108.8	390.7 $\pm$ 92.2	470.8 $\pm$ 105.7 [#]	448.4 $\pm$ 99.3 [#]	435.0 $\pm$ 104.4 [#]
Cor (ng/mL)	T	30	166.3 $\pm$ 37.6	187.0 $\pm$ 38.9	230.2 $\pm$ 44.3 ^{*#}	221.5 $\pm$ 39.7 ^{*#}	212.7 $\pm$ 41.3 ^{*#}
	C	30	171.9 $\pm$ 41.1	202.4 $\pm$ 45.5	266.7 $\pm$ 48.3 [#]	249.9 $\pm$ 42.8 [#]	241.7 $\pm$ 45.4 [#]

Note: * P<0.05 compared with group C; # P<0.05 compared with T0.

表 4 两组拔管期间指标的比较($\bar{x} \pm s$)

Table 4 Comparison of parameters during extubation and consumption of anesthetics ($\bar{x} \pm s$)

Groups	Amount (n)	Extubation quality score	Ricker sedation-agitation scale
T	30	1.55 $\pm$ 1.00 [*]	3.60 $\pm$ 1.27 [*]
C	30	3.05 $\pm$ 1.33	5.00 $\pm$ 1.52

Note: * P < 0.05 compared with group C.

用,且其也有一定的心肌保护作用,在一定程度上可以促进心脏功能的恢复^[12,13];尺泽穴也属于手太阴肺经穴,清宣肺气,泻火降逆的作用,两者均可用于治疗急慢性咳嗽以及顽固性呃逆^[14]。所以本研究选择经皮穴位电刺激这四个穴位来观察其对拔管期间应激反应的影响。

经皮穴位电刺激能够减轻患者在围术期的应激反应,降低静脉血中儿茶酚胺的浓度,有利于血流动力学稳定^[15,16]。本研究结果也显示经皮穴位电刺激(T)组患者相对于假电刺激(C)组患者在拔管后即刻、拔管后 5 min 以及拔管后 10 min 的血压,平均动脉压,心率和静脉血中的肾上腺素、去甲肾上腺素、皮质醇的浓度均发生不同程度的降低,可见经皮穴位电刺激能够改变中枢及植物神经系统对机体的调节和控制作用,可降低交感-肾上腺素髓质系统的兴奋性及静脉血中的儿茶酚胺的浓度,从而有利于维持血流动力学稳定^[17]。有研究表明^[18,19]经皮穴位电刺激能够减少围术期镇痛药物的用量,提高麻醉恢复期的质量。本研究结果显示 T 组患者的拔管质量评分以及 Ricker 镇静-躁动评分均降低,表明经皮穴位电刺激具有镇静和镇痛作用,其原因可能为经皮穴位电刺激能够兴奋中枢神经系统中的传入神经或者粗纤维,从而导致内源性的脑啡肽和强啡肽的释放,阻止疼痛信息的上传,同时还可通过抑制中枢神经细胞对外周传入疼痛信息的感受产生一定的镇痛和镇静作用^[20-22]。

综上所述,经皮穴位电刺激能够减轻甲状腺次全切除术患

者全麻拔管期的应激反应,有利于维持血流动力学稳定。

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