

本文引用:齐金莲,王文华,何秋娟,等.肋间神经阻滞联合喉罩全身麻醉在小儿先天性心脏病介入封堵术中的应用效果[J].新乡医学院学报,2023,40(9):846-850. DOI:10.7683/xyxyxb.2023.09.008.

【临床研究】

# 肋间神经阻滞联合喉罩全身麻醉在小儿先天性心脏病介入封堵术中的应用效果

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**摘要:** **目的** 探讨肋间神经阻滞(ICNB)联合喉罩全身麻醉在小儿先天性心脏病介入封堵术中的应用效果与安全性。**方法** 选择2022年1月至2022年10月河南省儿童医院收治的112例先天性心脏病患儿为研究对象,所有患儿行介入封堵术,根据麻醉方法将患儿分为观察组和对照组。观察组患儿给予ICNB联合喉罩全身麻醉,对照组患儿给予气管插管全身麻醉。记录2组患儿的麻醉时间、手术时间、瑞芬太尼用量、麻醉后复苏室(PACU)停留时间、拔出喉罩或气管导管时间、不良反应及麻醉诱导前( $T_0$ )、插入喉罩或气管导管后即刻( $T_1$ )、切皮时( $T_2$ )、置入封堵器即刻( $T_3$ )、气管导管或喉罩去除即刻( $T_4$ )、苏醒即刻( $T_5$ )的心率(HR)和平均动脉压(MAP)。术后1、4、8、12、24 h,采用Wong-baker脸谱或FLACC评分法评估患儿的疼痛程度。**结果**  $T_0$ 、 $T_5$ 时,2组患儿的MAP、HR比较差异无统计学意义( $P>0.05$ ); $T_1$ 、 $T_2$ 、 $T_3$ 、 $T_4$ 时,观察组患儿的MAP、HR均显著低于对照组( $P<0.05$ );术后1~24 h,2组患儿疼痛评分均呈升高趋势( $P<0.05$ );术后1、4 h时,2组患儿的疼痛评分比较差异无统计学意义( $P>0.05$ );术后8、16、24 h时,观察组患儿的疼痛评分均显著低于对照组( $P<0.05$ )。2组患儿的手术时间、麻醉时间比较差异无统计学意义( $P>0.05$ );观察组患儿瑞芬太尼用量显著少于对照组,PACU停留时间、拔出喉罩或气管导管时间显著短于对照组( $P<0.05$ )。观察组患儿苏醒躁动、咽喉痛、呛咳、恶心呕吐的发生率显著低于对照组( $\chi^2=4.940/4.264/10.500$ ,  $P<0.05$ )。**结论** ICNB联合喉罩全身麻醉用于先天性心脏病介入封堵术可维持患儿血流动力学稳定,且镇痛效果好、并发症少。

**关键词:** 先天性心脏病;肋间神经阻滞;喉罩;介入封堵术

**中图分类号:** R722.19 **文献标志码:** A **文章编号:** 1004-7239(2023)09-0846-05

## Application effect of intercostal nerve block combined with laryngeal mask general anesthesia in interventional closure in children with congenital heart disease

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**Abstract:** **Objective** To investigate the application effect and safety of intercostal nerve block combined with laryngeal mask general anesthesia in interventional closure of congenital heart disease in children. **Methods** A total of 112 children with congenital heart disease admitted to Henan Children's Hospital from January 2022 to October 2022 were selected as the research subjects. All children underwent interventional closure and were divided into observation group and control group according to the anesthesia method. The children in the observation group received intercostal nerve block (ICNB) and general anesthesia of laryngeal mask airway, and the children in the control group were given general anesthesia of tracheal intubation. The anesthesia time, operation time, dosage of remifentanyl, stay time in post-anesthesia care unit (PACU), removal time of laryngeal mask or endotracheal tube and adverse reactions of children were recorded. The heart rate (HR) and mean arterial pressure (MAP) of children were recorded before anesthesia induction ( $T_0$ ) and at once after insertion of laryngeal mask or tracheal tube ( $T_1$ ), skin incision ( $T_2$ ), occluder placement ( $T_3$ ), removal of tracheal tube or laryngeal mask ( $T_4$ ) and recovery ( $T_5$ ). At 1, 4, 8, 12 and 24 hours after operation, the pain degree of the children was evaluated by Wong-baker faces or FLACC score. From 1 to 24 hours after surgery, the pain scores of children in the two groups showed an upward trend ( $P<0.05$ ). There was no statistically significant difference in the pain score of children between the two groups at 1 and 4 hours after

DOI:10.7683/xyxyxb.2023.09.008

收稿日期:2023-03-13

基金项目:河南省医学科技攻关计划项目(编号:2018020689, LHGJ20210676, LHGJ20190956)。

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surgery ( $P>0.05$ ). At 8, 16 and 24 hours after surgery, the pain scores of children in the observation group were significantly lower than those in the control group ( $P<0.05$ ). There was no statistically significant difference in the operation time and anesthesia time of children between the two groups ( $P>0.05$ ). The dosage of remifentanyl in the observation group was significantly lower than that in the control group, and the retention time in PACU and the removal time of laryngeal mask or tracheal catheter were significantly shorter than those in the control group ( $P<0.05$ ). The incidences of restlessness, sore throat, cough, nausea and vomiting of children in the observation group were significantly lower than those in the control group ( $\chi^2=4.940, 4.264, 10.500; P<0.05$ ). **Conclusion** ICNB combined with laryngeal mask general anesthesia for interventional closure of children with congenital heart defect can maintain the stability of hemodynamics, and has good analgesic effect and fewer complications.

**Key words:** congenital heart defect; intercostal nerve block; laryngeal mask; interventional closure surgery

介入封堵术已成为小儿先天性心脏病的重要治疗方法,具有创伤小、疗效好、恢复快等优点<sup>[1]</sup>。介入封堵治疗时,麻醉方式对保持围手术期患儿的气道通畅、血流动力学稳定及减少术后并发症具有直接影响。超声引导下肋间神经阻滞(intercostal nerve block, ICNB)因侵入性小、操作简单、镇痛效果好等优点,已被广泛应用于小儿胸外科手术<sup>[2]</sup>。喉罩也常用于全身麻醉时的通气管管理,其有利于维持患者血流动力学稳定,促进术后恢复,减少并发症<sup>[3]</sup>。ICNB联合喉罩全身麻醉较适合于小儿先天性心脏病介入封堵术,但目前相关文献报道较少。本研究旨在观察ICNB联合喉罩全身麻醉在小儿先天性心脏病介入封堵术中的应用效果和安全性,以为小儿先天性心脏病介入封堵术临床麻醉方法的选择提供参考。

## 1 资料与方法

### 1.1 一般资料

选择2022年1月至2022年10月河南省儿童医院收治的先天性心脏病患儿为研究对象。病例纳入标准:(1)符合小儿先天性心脏病介入治疗标准<sup>[4]</sup>,并经影像学检查确诊;(2)符合介入封堵术的手术指征,均行介入封堵术;(3)口腔和喉部的结构无异常;(4)美国麻醉学学会分级Ⅱ级,无麻醉药物过敏史。排除标准:(1)合并感染性疾病;(2)凝血功能异常;(3)ICNB区域感染。本研究共纳入先天性心脏病患儿112例,所有患儿行介入封堵术,根据麻醉方法将患儿随机分为观察组和对照组,每组56例。观察组:男33例,女23例;年龄2~7(3.89±1.19)岁;体质指数14.75~17.44(16.04±0.63)kg·m<sup>-2</sup>;室间隔缺损21例,房间隔缺损35例。对照组:男30例,女26例;年龄2~7(3.53±1.02)岁;体质指数14.53~18.11(15.87±0.66)kg·m<sup>-2</sup>;室间隔缺损24例,房间隔缺损32例。2组患儿的性别、年龄、体质指数、疾病类型比较差异无统计学意义( $P>$

0.05),具有可比性。本研究经医院伦理委员会批准(伦理批准文号:2023-k-076),所有患儿家属签署知情同意书。

### 1.2 麻醉方法

患儿在手术接待室静脉给予依托咪酯(江苏恩华药业股份有限公司,国药准字H20020511)0.20 mg·kg<sup>-1</sup>,咪达唑仑(江苏恩华药业股份有限公司,国药准字H10980025)0.05 mg·kg<sup>-1</sup>,待患儿镇静后接入手术室,连接监护仪监测其心率(heart rate, HR)、呼吸频率(respiratory rate, RR)、心电图(electrocardiogram, ECG)、血压(blood pressure, BP)、脉搏血氧饱和度(pulse oxygen saturation, SpO<sub>2</sub>)、呼气末二氧化碳分压(end-tidal pressure of carbon dioxide, PETCO<sub>2</sub>)、脑电双频谱指数(bispectral index, BIS)。麻醉诱导:所有患儿静脉注射丙泊酚(AstraZeneca UK Limited,进口药品注册证号:J20110004)2 mg·kg<sup>-1</sup>、舒芬太尼(宜昌人福药业有限责任公司,国药准字H20054171)0.20 μg·kg<sup>-1</sup>、顺势苯磺酸阿曲库胺(江苏恒瑞医药股份有限公司,国药准字H20183042)0.15 mg·kg<sup>-1</sup>、瑞芬太尼(宜昌人福药业有限责任公司,国药准字H20030197)2.00 μg·kg<sup>-1</sup>。

待患儿下颌松弛、BIS降至60以下后,观察组患儿置入型号大小合适的喉罩,超声引导下进行ICNB;对照组患儿在可视喉镜下插入型号大小合适的气管导管;操作均由2位熟练应用超声及插管的高年资医师完成。神经阻滞用药是2.5 g·L<sup>-1</sup>罗哌卡因(广东嘉博制药有限公司,国药准字H20133178)1 mL·kg<sup>-1</sup>。麻醉维持:术中持续静脉泵注丙泊酚8~10 mg·kg<sup>-1</sup>·h<sup>-1</sup>、瑞芬太尼20 μg·kg<sup>-1</sup>·h<sup>-1</sup>、右美托咪定0.5 μg·kg<sup>-1</sup>·h<sup>-1</sup>,复合吸入体积分数1%~3%七氟烷(上海恒瑞医药有限公司,国药准字H20070172),维持BIS值40~60。手术结束停止麻醉药物,将患儿送入麻醉后复苏室(post-anesthesia care unit, PACU)。

1.3 观察指标

(1)手术情况:麻醉时间、手术时间。(2)HR 和 MAP:记录 2 组患儿麻醉诱导前( $T_0$ )、插入喉罩或气管导管后即刻( $T_1$ )、切皮时( $T_2$ )、置入封堵器即刻( $T_3$ )、气管导管或喉罩去除即刻( $T_4$ )、苏醒即刻( $T_5$ )的 HR 和 MAP。(3)采用 Wong-baker 脸谱或 FLACC 评分法评估患儿术后 1、4、8、12、24 h 的疼痛程度,0 分为无疼痛,1~3 分为轻度疼痛,4~6 分为中度疼痛,7~10 分为严重疼痛。(4)记录 2 组患儿瑞芬太尼用量、PACU 停留时间、拔出喉罩或气管导管时间(入 PACU 至拔出气管导管或喉罩的时间)、不良反应(苏醒期躁动、咽喉疼、低氧血症、呛咳、恶心呕吐等)。

1.4 统计学处理

应用 SPSS 23.0 软件对数据进行统计学分析。计量资料以均数±标准差( $\bar{x} \pm s$ )表示,组间比较采用独立样本  $t$  检验,组内不同时间点数据比较采用重复测量方差分析;计数资料以例数和百分率表示,组间比较采用  $\chi^2$  检验; $P < 0.05$  为差异有统计学意义。

2 结果

2.1 2 组患儿的 MAP 和 HR 比较

$T_0$ 、 $T_5$  时,2 组患儿的 MAP、HR 比较差异无统计学意义( $P > 0.05$ ); $T_1$ 、 $T_2$ 、 $T_3$ 、 $T_4$  时,观察组患儿

的 MAP、HR 均显著低于对照组,差异有统计学意义( $P < 0.05$ );见表 1。

表 1 2 组患儿的 MAP 和 HR 比较

Tab.1 Comparison of the MAP and HR of children between the two groups ( $\bar{x} \pm s$ )

组别	<i>n</i>	MAP/mm Hg	HR/(次·min <sup>-1</sup> )
对照组	56		
$T_0$		70.79 ± 2.24	107.62 ± 6.81
$T_1$		79.19 ± 2.17	126.39 ± 6.85
$T_2$		76.89 ± 2.37	124.31 ± 5.91
$T_3$		74.34 ± 1.91	106.25 ± 6.49
$T_4$		81.09 ± 2.28	131.71 ± 6.03
$T_5$		69.78 ± 2.83	111.77 ± 5.85
观察组	56		
$T_0$		71.44 ± 2.15	108.01 ± 7.01
$T_1$		61.58 ± 2.23 <sup>a</sup>	93.78 ± 5.77 <sup>a</sup>
$T_2$		61.48 ± 2.16 <sup>a</sup>	95.18 ± 6.68 <sup>a</sup>
$T_3$		61.12 ± 2.13 <sup>a</sup>	95.87 ± 5.89 <sup>a</sup>
$T_4$		63.51 ± 2.19 <sup>a</sup>	113.98 ± 5.66 <sup>a</sup>
$T_5$		70.61 ± 2.47	110.91 ± 6.85

注:与对照组比较<sup>a</sup> $P < 0.05$ ;1 mm Hg = 0.133 kPa。

2.2 2 组患儿术后疼痛评分比较

术后 1~24 h,2 组患儿疼痛评分均呈升高趋势( $P < 0.05$ );术后 1、4 h 时,2 组患儿的疼痛评分比较差异无统计学意义( $P > 0.05$ );术后 8、16、24 h 时,观察组患儿的疼痛评分均显著低于对照组,差异有统计学意义( $P < 0.05$ );见表 2。

表 2 2 组患儿术后疼痛评分比较

Tab.2 Comparison of postoperative pain scores of children between the two groups ( $\bar{x} \pm s$ )

组别	<i>n</i>	疼痛评分					<i>F</i>	<i>P</i>
		术后 1 h	术后 4 h	术后 8 h	术后 16 h	术后 24 h		
对照组	56	1.68 ± 0.64	2.21 ± 0.68	3.54 ± 0.95	4.63 ± 0.82	4.84 ± 0.78	4 846.434	<0.05
观察组	56	1.71 ± 0.65	2.12 ± 0.61	2.28 ± 0.89	3.08 ± 0.92	3.43 ± 0.63	2 500.864	<0.05
<i>t</i>		0.293	-0.734	-7.180	-9.317	-10.531		
<i>P</i>		>0.05	>0.05	<0.05	<0.05	<0.05		

2.3 2 组患儿手术时间、麻醉时间、瑞芬太尼用量、PACU 停留时间及拔出喉罩或气管导管时间比较

2 组患儿的手术时间、麻醉时间比较差异无统计学意义( $P > 0.05$ );观察组患儿瑞芬太尼用量显

著少于对照组,PACU 停留时间、拔出喉罩或气管导管时间显著短于对照组,差异有统计学意义( $P < 0.05$ );见表 3。

表 3 2 组患儿手术时间、麻醉时间、瑞芬太尼用量、PACU 停留时间及拔出喉罩或气管导管时间比较

Tab.3 Comparison of the operation time,anesthesia time,dosage of remifentanyl,stay time in PACU and removal time of laryngeal mask or tracheal catheter of children between the two groups ( $\bar{x} \pm s$ )

组别	<i>n</i>	手术时间/min	麻醉时间/min	瑞芬太尼用量/ $\mu$ g	PACU 停留时间/min	拔管/喉罩时间/min
对照组	56	50.09 ± 5.77	68.12 ± 4.23	331.27 ± 51.01	42.04 ± 2.84	8.46 ± 1.64
观察组	56	49.95 ± 5.69	67.28 ± 5.19	210.79 ± 39.55	31.42 ± 2.61	6.21 ± 1.58
<i>t</i>		0.132	-0.937	-13.971	-20.587	-7.392
<i>P</i>		>0.05	>0.05	<0.05	<0.05	<0.05

2.4 2 组患儿不良反应比较

观察组患儿苏醒期躁动、咽喉痛、呛咳、恶心呕

吐的发生率显著低于对照组,差异有统计学意义( $P < 0.05$ );见表 4。

表 4 2 组患儿不良反应比较

Tab.4 Comparison of the adverse reactions of children between the two groups 例(%)

组别	n	苏醒期躁动	咽喉痛	呛咳	恶心呕吐
对照组	56	9(16.1)	10(17.9)	14(25.0)	8(14.3)
观察组	56	2(3.6)	3(5.4)	2(3.6)	2(3.6)
$\chi^2$		4.940	4.264	10.500	3.953
P		<0.05	<0.05	<0.05	<0.05

3 讨论

室间隔缺损、房间隔缺损的介入封堵术较传统开胸、体外循环手术方式更简便,创伤小,有利于患儿术后恢复。介入封堵术从右侧第3、4肋间开口,在食管超声引导下实施,精细度要求高,麻醉要在保证患儿安全的前提下力求舒适平稳,加快康复,因此,选择最佳麻醉方案是围手术期的关键。经胸心脏病介入封堵术需要在食管超声的指导下完成,为方便食管超声的置入,常采用的麻醉方法是气管插管全身麻醉,但气管插管刺激强,呼吸道并发症多。本研究选用全身麻醉喉罩通气,将喉罩前端罩杯剪开方便食管超声置入,目的是最大程度减轻对呼吸道的刺激,同时实施 ICNB 可最大化地减轻疼痛及减少阿片类药物的应用,为患儿提供舒适化的麻醉管理。

本研究结果显示,对照组患儿围手术期 MAP、HR 波动幅度大,而观察组患儿血流动力学比较稳定; T<sub>1</sub>、T<sub>2</sub>、T<sub>3</sub>、T<sub>4</sub> 时观察组患儿的 MAP、HR 均显著低于对照组。观察组患儿采用喉罩通气,喉罩操作方便,仅置于咽腔,对咽喉刺激小,对患儿血流动力学影响较小。对照组患儿给予气管插管,在暴露声门及气管导管插管、拔管时对会厌、咽喉部、舌根颈部肌肉感受器及气管黏膜的刺激明显大于喉罩置入的刺激,对患儿血流动力学影响较大。这与 BHUSHAN 等<sup>[5]</sup>在腹腔镜胆囊切除术中采用喉罩通气观察结果一致<sup>[6]</sup>。与对照组相比,观察组患儿提前实施了超声引导下的 ICNB,阻断了手术切口(T<sub>2</sub>)及通过切口置入封堵器时(T<sub>3</sub>)神经冲动的传导,有效地缓解了手术切口部位的疼痛,因此,观察组患儿的血流动力学比较平稳<sup>[7-8]</sup>。

本研究结果显示,术后 1、4 h 时 2 组患儿的疼痛评分比较差异无统计学意义(P>0.05);术后 8、16、24 h 时,观察组患儿的疼痛评分均显著低于对照组。究其原因,首先,观察组患儿在麻醉诱导后实施了超声引导下 ICNB 超前镇痛,有效减少了引起疼痛的伤害性刺激进入中枢神经系统,避免了中枢的疼痛敏化,产生了持续的镇痛作用<sup>[9]</sup>;其次,局部麻醉药物罗哌卡因可以与阿片类镇痛药物起到协同作用,阻断疼痛信息通过脊神经根向中枢神经的传入;因此,观察组患儿术后疼痛评分显著低于对照

组。这与 LUKOSIENE 等<sup>[10]</sup>研究结果一致。

观察组患儿围手术期实施了 ICNB,减少了围手术期瑞芬太尼的用量,患儿的喉罩拔出时间、PACU 停留时间显著短于对照组,这与 ALTUN 等<sup>[11]</sup>研究结果一致。本研究是在超声引导下行 ICNB,通过可视化设备对胸膜、肋间下缘位置进行有效的定位,肋间内肌和肋间最内肌肌间被识别后,能够可视化局部麻醉药物的扩散,对阻滞肋间神经进行精准浸润<sup>[12]</sup>,未发现局麻药罗哌卡因中毒和气胸现象。本研究结果显示,观察患儿苏醒期躁动、咽喉痛、呛咳、恶心呕吐的发生率显著低于对照组。采用喉罩气道替代气管导管气道,喉罩置入和拔出对气道的刺激小,降低了患儿喉痉挛、呛咳、咽喉痛的发生率,这与 ZHONG 等<sup>[13]</sup>、MENA 等<sup>[14]</sup>的研究结果一致。观察组患儿的苏醒期躁动发生率显著低于对照组。导致术后躁动的原因很多,包括吸入性麻醉药的使用、快速复苏、手术方式、术后疼痛、气道不适等,但术后疼痛和气道不适是术后躁动的主要因素。观察组患儿苏醒期躁动发生率低,主要是由于观察组患儿采用 ICNB 联合喉罩全身麻醉,喉罩对气道刺激小且 ICNB 能产生持续的镇痛<sup>[15-16]</sup>。

4 结论

ICNB 联合喉罩全身麻醉用于小儿先天性心脏病介入封堵术具有血流动力学稳定、镇痛效果好、并发症少等优势;但是,喉罩有移位导致通气不足、漏气导致胃胀气等风险,需要有经验的麻醉医师实施。

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( 本文编辑: 李胜利 )