

doi: 10.13241/j.cnki.pmb.2019.04.035

低体质量小儿心脏手术中应用七氟醚全身麻醉诱导的效果 及其对血流动力学的影响*

罗亮 刘少星 朱波 蒋蓉娟 谢先丰[△]

(成都市第二人民医院麻醉科 四川 成都 610016)

摘要 目的:探讨低体质量小儿心脏手术中应用七氟醚全身麻醉诱导的效果及其对血流动力学的影响。**方法:**选择本院 2016 年 7 月-2018 年 2 月期间收治的 28 例低体质量小儿心脏手术患儿纳入本研究,按照随机数字表法将患儿分为对照组和观察组各 14 例。对照组采用氯胺酮进行全身麻醉诱导,观察组采用七氟醚吸入麻醉进行全身麻醉诱导。观察两组患儿麻醉诱导敏感性和不良反应等情况,比较两组患儿诱导前、诱导过程中、插管即刻的收缩压(SBP)、舒张压(DBP)、心率(HR)及血氧饱和度(SaO₂)水平。**结果:**观察组患儿哭闹时间、睫毛反射消失时间及疼痛反射消失时间显著低于对照组($P<0.05$)。观察组患儿不良反应发生率为 7.14%(1/14),与对照组的 28.57%(4/14)比较差异无统计学意义($P>0.05$)。诱导过程中及插管即刻,对照组患儿 SBP、DBP 均低于诱导前和观察组,HR 高于诱导前和观察组,SaO₂ 先降低后升高,且低于观察组($P<0.05$),观察组患儿 SBP 低于诱导前,SaO₂ 高于诱导前($P<0.05$),而 DBP、HR 与诱导前比较无统计学差异($P>0.05$)。**结论:**与氯胺酮相比,采用七氟醚吸入全身诱导麻醉,其对低体质量小儿心脏手术患儿的循环干扰较小,同时在诱导过程中安全稳定,对血流动力学影响较小,容易被患儿所接受。

关键词:低体质量;心脏手术;患儿;七氟醚;氯胺酮;血流动力学

中图分类号:R726;R654.2 文献标识码:A 文章编号:1673-6273(2019)04-763-04

Effect of Sevoflurane General Anesthesia Induction on Cardiac Surgery of Low Body Mass Children and its Influence of Hemodynamics*

LUO Liang, LIU Shao-xing, ZHU Bo, JIANG Rong-juan, XIE Xian-feng[△]

(Department of Anesthesiology, Chengdu Second People's Hospital, Chengdu, Sichuan, 610016, China)

ABSTRACT Objective: To investigate the effect of sevoflurane general anesthesia induction on cardiac surgery of low body mass children and its influence of hemodynamics. **Methods:** 28 children with low body mass undergoing cardiac surgery in our hospital from July 2016 to February 2018 were included in this study. According to the random number table method, the children were divided into the control group and the observation group, 14 cases in each group. The control group was induced by Ketamine for general anesthesia, and the observation group was given sevoflurane inhalation anesthesia for induction of general anesthesia. The sensitivity and adverse reactions of the two groups were observed. The levels of systolic pressure(SBP), diastolic pressure(DBP), heart rate(HR), oxygen saturation (SaO₂) before induction, induction process, intubation immediately of the two groups were compared. **Results:** The crying time, eyelash reflex disappearing time and the pain reflex disappearing time in observation group significantly were lower than that in the control group ($P<0.05$). The incidence rate of adverse reactions in the observation group was 7.14%(1/14), there is no statistical difference compared with the 28.57%(4/14) in the control group ($P>0.05$). In the induction process and intubation immediately, the SBP and DBP in the control group were lower than before induction and the observation group, the HR was higher than before induction and the observation group, the SaO₂ decreased first and then increased, and was lower than that in the observation group($P<0.05$). The SBP in the observation group was lower than before induction, and the SaO₂ was higher than before induction ($P<0.05$), but there was no statistical difference of DBP and HR compared with before induction ($P>0.05$). **Conclusion:** Compared with Ketamine, using sevoflurane inhalation of general induction anesthesia has less disturbance to the cardiac surgery children with low body mass, and it is safe and stable in the induction process, and has less influence on the hemodynamics, which is easy to be accepted by children.

Key words: Low body mass; Cardiac surgery; Children; Sevoflurane; Ketamine; Hemodynamics

Chinese Library Classification(CLC): R726; R654.2 **Document code:** A

Article ID: 1673-6273(2019)04-763-04

前言

低体重儿童主要是指在未足月情况下离开母体,由于新生儿机体的各个系统和器官并未完全成熟,进而增加并发症发生

* 基金项目:四川省医学会科研基金项目(S16004)

作者简介:罗亮(1973-),男,本科,副主任医师,从事麻醉方面的研究,E-mail: iueuxj@163.com

△ 通讯作者:谢先丰(1963-),男,硕士,主任医师,从事麻醉方面的研究,E-mail: kayysshah@163.com

(收稿日期:2018-05-24 接受日期:2018-06-18)

率和死亡率^[1-3]。对于低体质量小儿心脏手术患儿来说,其自身抵抗力较差,难以耐受疼痛容易出现哭闹现象,进而影响手术的顺利进行,耽误治疗最佳时机^[4,5]。为此,选择一种较为理想的麻醉药物来保障手术顺利进行,对患儿的生命安全具有重要意义^[6,7]。七氟醚是一种无色透明、芳香无刺激的麻醉药物,并且采用经面罩吸入的方式,可减轻患儿的恐惧心理,简便无痛苦^[8,9]。七氟醚麻醉诱导快,麻醉深度容易调节,诱导期患儿比较平静,且对循环功能抑制作用弱,肌松药用量小,术后苏醒快等优点,因此,在小儿心脏手术中具有重要的地位^[10,11]。本研究为探讨和分析七氟醚用于低体质量小儿心脏手术中的效果,对本研究的患儿采用七氟醚进行全身麻醉诱导,并与氯胺酮进行比较,现分析如下。

1 资料与方法

1.1 一般资料

选择本院 2016 年 7 月 -2018 年 2 月期间收治的 28 例低体质量小儿心脏手术患儿。纳入标准:(1)患儿均为左向右分流型、体外循环下室间隔缺损;(2)美国麻醉医师学会分级为 II 级;(3)心功能分级为 I - II 级;(4)患儿家属均知情同意,并签署知情同意书。排除标准:(1)肺动脉高压者;(2)合并严重心肺功能障碍者、恶性肿瘤者;(3)无法正常配合研究的患儿。按照随机数字表法将患儿分为对照组和观察组各 14 例。对照组男童 9 例,女童 5 例;年龄 0.73-1.82 岁,平均(1.05± 0.19)岁;体质量 7.24-9.48 kg,平均(8.63± 0.56)kg。观察组男童 8 例,女童 6 例;年龄 0.65-1.79 岁,平均(0.97± 0.16)岁;体质量 7.38-9.29 kg,平均(8.51± 0.43)kg。两组患儿一般资料比较无统计学差异($P>0.05$),均衡可比。我院伦理委员会已允许实施本次研究。

1.2 方法

两组患儿术前均禁食 3 h,禁水 1 h。对照组采用氯胺酮(江苏盛迪医药有限公司,国药准字:H32025255)进行全身麻醉诱导,静脉注射 1.0~2.0 mg/kg,1 min 内注入。待患儿睫毛反射消

失后可开放静脉,并肌肉注射长托宁(成都力思特制药股份有限公司,国药准字:H20163223)0.02 mg/kg,静脉给予芬太尼(宜昌人福药业有限责任公司,国药准字:H20030198)10 Lg/kg,哌库溴铵(四川科瑞德凯华制药有限公司,国药准字:H20080611)0.1 mg/kg,咪唑安定(江苏九旭药业有限公司,国药准字:H20153019)0.1 mg/kg,然后快速进行气管内插管。观察组采用七氟醚(上海恒瑞医药有限公司,国药准字:H20070172)吸入麻醉进行全身麻醉诱导。给患儿采用面罩吸入氧气 5~6 L/min+8%七氟醚进行诱导。待患儿疼痛反射消失后开放静脉,并肌肉注射长托宁 0.02 mg/kg,静脉给予芬太尼 10 Lg/kg,然后快速进行气管内插管。两组患儿均采用机械控制呼吸。

1.3 观察指标

观察两组患儿麻醉诱导敏感性情况,包括患儿哭闹时间、睫毛反射消失时间和疼痛反射消失时间。比较两组患儿诱导前、诱导过程中、插管即刻收缩压(systolic pressure,SBP)、舒张压(diastolic pressure,DBP)、心率(heart rate,HR)及血氧饱和度(oxygen saturation,SaO₂)水平,血氧饱和度仪(PM-60)购自深圳迈瑞生物医疗电子股份有限公司。观察治疗过程中两组患儿不良反应发生情况,如有无谵妄躁动、呛咳、支气管痉挛、分泌物增多及心律变化等情况。

1.4 统计学方法

数据采用 SPSS19.0 软件处理。谵妄躁动、分泌物增多发生率等计数资料采用[n(%)]表示,实施 χ^2 检验,SaO₂、睫毛反射消失时间等计量资料采用均数± 标准差($\bar{x} \pm s$)表示,实施 t 检验, $P<0.05$ 具有统计学意义。

2 结果

2.1 麻醉诱导敏感性

观察组患儿哭闹时间、睫毛反射消失时间及疼痛反射消失时间显著低于对照组($P<0.05$),如表 1。

表 1 两组患儿麻醉诱导敏感性情况比较($\bar{x} \pm s$)

Table 1 Comparison of susceptibility to anesthesia induction in the two groups($\bar{x} \pm s$)

Groups	Crying time	Eyelash reflex disappearing time	Pain reflex disappearing time
Control group(n=14)	84.02± 5.14	78.54± 6.01	112.31± 5.14
Observation group(n=14)	42.15± 3.62	39.67± 5.27	46.97± 4.01
t	6.919	8.195	9.502
P	0.000	0.000	0.000

2.2 血流动力学情况

诱导前,两组患儿血流动力学比较差异无统计学意义($P>0.05$);诱导过程中及插管即刻,对照组患儿 SBP、DBP 均低于诱导前和观察组,HR 高于诱导前和观察组,SaO₂ 先降低后升高,且低于观察组($P<0.05$),观察组患儿 SBP 低于诱导前,SaO₂ 高于诱导前($P<0.05$),而 DBP、HR 与诱导前比较无统计学差异($P>0.05$),如表 2。

2.3 不良反应

观察组患儿不良反应发生率为 7.14%(1/14),与对照组的 28.57%(4/14)比较差异无统计学意义($P>0.05$),如表 3。

3 讨论

一般情况下,低体质量儿童的临床情况较差,且心脏疾病患儿还存在重要脏器缺氧的情况,患儿心肺功能发育不良,当患儿稍微活动或者哭闹后则会发生紫绀现象^[12-14]。在对患儿实施心脏手术麻醉诱导时需患儿尽量保持安静、平稳,患儿一旦出现哭闹或躁动等情况,其需氧及耗氧量会急剧增加,进而加重患儿病情^[15,16]。同时有可能会诱发患儿发生右心室漏斗部痉挛情况,减少肺血流,增加右向左分流情况,使得患儿动脉血氧饱和度明显下降,进而使得患儿心脏负荷加重^[17]。如果处理

表 2 两组患儿血流动力学情况比较($\bar{x} \pm s$)Table 2 Comparison of hemodynamics in the two groups($\bar{x} \pm s$)

Groups	Times	SBP(mmHg)	DBP(mmHg)	HR(n/min)	SaO ₂ (%)
Control group(n=14)	Before induction	105.97± 8.47	61.24± 6.01	124.18± 14.76	94.57± 1.14
	In the induction process	71.17± 2.35*	46.97± 4.42*	181.01± 12.30*	84.15± 1.49*
	Intubation immediately	75.30± 5.26*	44.16± 3.57*	157.96± 10.96*	97.89± 1.08*
Observation group (n=14)	Before induction	106.01± 8.51	60.97± 6.05	123.96± 14.82	94.61± 1.09
	In the induction process	97.75± 4.99 [#]	61.02± 5.32 [#]	122.69± 10.28 [#]	99.01± 2.41 [#]
	Intubation immediately	90.28± 3.42 [#]	59.01± 3.48 [#]	119.65± 12.02 [#]	99.87± 1.58 [#]

Note: Compared with before induction, *P<0.05; Compared with control group, [#]P<0.05.

表 3 两组患儿不良反应情况比较[n(%)]

Table 3 Comparison of adverse reactions in the two groups[n(%)]

Groups	Delirium and restlessness	Cough	Bronchospasm	Increase of secretion	Arrhythmia	Total incidence
Control group (n=14)	1(7.14)	1(7.14)	0(0.00)	1(7.14)	1(7.14)	4(28.57)
Observation group (n=14)	0(0.00)	1(7.14)	0(0.00)	0(0.00)	0(0.00)	1(7.14)
χ^2						2.191
P						0.139

不当或处理不及时,患儿长期处于哭闹或者躁动状态下则会导致患儿发生严重性缺氧和心律失常等情况,增加患儿发生心脏骤停的风险,严重威胁患儿的生命健康^[18-20]。所以,平稳全身麻醉诱导可保障心脏手术的顺利进行,进而保障患儿生命健康。在对患儿实施心脏手术麻醉诱导,最为关键的是患儿进入到手术室到开放静脉通道这段过程,患儿自身的紧张和害怕使得其难以配合手术而出现哭闹及躁动,增加了严重性缺氧和低血压等危险情况的发生概率。因此,在患儿基础麻醉及诱导下使得患儿安静之后,要立即开放静脉通道而实施后续麻醉处理^[21-22]。

本次研究中所使用到的氯胺酮,其存在正性肌力效果,具有增加心率和外周血管阻力的效果,同时还可降低患儿肺血管阻力和扩张支气管等^[23,24]。麻醉前吸入高浓度氧,然后采用氯胺酮进行麻醉可有效提高患儿血氧饱和度^[25]。此外,氯胺酮还可增加患儿血浆 HSP70 水平,抑制患儿炎症反应,减轻缺血再灌注过程中所出现的心肌损害,提高心脏手术的麻醉效果^[26]。然给患儿采用氯胺酮麻醉诱导时间较长,这主要是因为患儿在诱导过程中出现长期缺氧情况而导致其外周血管发生痉挛,使得循环较为缓慢,同时诱导过程中,患儿出现哭闹及躁动情况也会导致患儿发生外周血管痉挛情况。本次研究中,采用氯胺酮诱导麻醉,患儿所出现的哭闹时间、睫毛反射消失时间及疼痛反射消失时间较长,同时发生缺氧及躁动情况较为严重,极易发生低血压等症状。

七氟醚为无色无味气体,对患儿气道刺激性较小,其血气分配系数为 0.63,采用面罩高浓度吸入后,其能迅速达到肺泡有效浓度^[27]。这种方法较为简单,且诱导过程十分迅速,并且产生的心血管抑制反应较弱。在对低体质量小儿心脏手术患儿进行麻醉诱导时,不会增加患儿气道分泌物,同时诱导时难以引起咳嗽等情况,极易被患儿所接受。此外,采用七氟醚吸入麻醉

诱导,其诱导过程中循环较为稳定,且患儿无明显躁动和严重性缺氧及低血压情况发生^[28]。七氟醚可兴奋患儿交感神经中枢,间接刺激肾上腺血管系统,更好地维持患儿较高的心率和血压,改善缺氧情况^[29]。同时七氟醚对患儿循环功能影响较小,对心肌具有一定保护效果,增加心肌储备能量,使得心肌 ATP 升高,延缓患儿 ATP 耗竭,降低患儿肺血管阻力,减少紫绀等各种并发症发生^[30]。经本次研究发现,观察组患儿不良反应发生率与对照组比较差异无统计学意义,诱导过程中及插管即刻,对照组患儿血流动力学出现明显改变,而观察组变化不明显。说明采用七氟醚用于低体质量小儿心脏手术全身麻醉诱导具有安全有效等优点。

综上所述,七氟醚应用于低体质量小儿心脏手术全身麻醉诱导中可减少患儿的哭闹时间,改善麻醉诱导敏感性与血流动力学情况,安全可靠。

参考文献(References)

- [1] Petry CJ, Ong KK, Beardsall K, et al. Vomiting in pregnancy is associated with a higher risk of low birth weight: a cohort study [J]. BMC Pregnancy Childbirth, 2018, 18(1): 133
- [2] Ballot DE, Ramdin T, Rakotsoane D, et al. Assessment of developmental outcome in very low birth weight infants in Southern Africa using the Bayley Scales of Infant Development (III)[J]. BMJ Paediatr Open, 2017, 1(1): e000091
- [3] Hsu CT, Chen CH, Lin MC, et al. Post-discharge body weight and neurodevelopmental outcomes among very low birth weight infants in Taiwan: A nationwide cohort study [J]. PLoS One, 2018, 13 (2): e0192574
- [4] Al-Radi OO. "Low Body Weight and Failure to Gain Weight are Risk Factors for Heart Surgery in Children"-Doctors Should Stop Saying That to Parents[J]. Semin Thorac Cardiovasc Surg, 2016, 28(1): e1-e2

- [5] Oshiro T, Nakayama O, Ohba C, et al. Transumbilical arterial embolization of a large dural arteriovenous fistula in a low-birth-weight neonate with congestive heart failure [J]. *Childs Nerv Syst*, 2016, 32(4): 723-726
- [6] Han D, Liu YG, Pan S, et al. Comparison of hemodynamic effects of sevoflurane and ketamine as basal anesthesia by a new and direct monitoring during induction in children with ventricular septal defect: A prospective, randomized research[J]. *Medicine (Baltimore)*, 2017, 96(50): e9039
- [7] Jang YE, Jeong SA, Kim SY, et al. The Efficacy of Intraoperative EEG to Predict the Occurrence of Emergence Agitation in the Postanesthetic Room After Sevoflurane Anesthesia in Children[J]. *J Perianesth Nurs*, 2018, 33(1): 45-52
- [8] 刘清玉,艾伟,刘波,等.异氟醚与七氟醚复合麻醉在小儿全身麻醉中的应用[J].*现代生物医学进展*, 2016, 16(2): 329-331
- [9] Wang CH, Luo J, Li J, et al. Efficacy of inhalational sevoflurane anesthesia induction on inhibiting the stress response to endotracheal intubation in children with congenital heart disease [J]. *Eur Rev Med Pharmacol Sci*, 2018, 22(4): 1113-1117
- [10] Bettex DA, Wanner PM, Bosshart M, et al. Role of sevoflurane in organ protection during cardiac surgery in children: a randomized controlled trial[J]. *Interact Cardiovasc Thorac Surg*, 2015, 20(2): 157-165
- [11] Kotwani MB, Malde AD. Comparison of maintenance, emergence and recovery characteristics of sevoflurane and desflurane in pediatric ambulatory surgery [J]. *J Anaesthesiol Clin Pharmacol*, 2017, 33(4): 503-508
- [12] Holt T, Filler G. Is it time for a multi-specialty approach to cardio-renal dysfunction in children with cyanotic congenital heart disease?[J]. *Pediatr Nephrol*, 2018, 33(3): 359-360
- [13] 冯龙,陈婷婷,周琪,等.低体重紫绀型婴幼儿先天性心脏病手术的麻醉管理[J].*中国体外循环杂志*, 2015, 13(4): 232-234
- [14] Animasahun BA, Madise-Wobo AD, Kusimo OY. Cyanotic congenital heart diseases among Nigerian children[J]. *Cardiovasc Diagn Ther*, 2017, 7(4): 389-396
- [15] Kim N, Park JH, Lee JS, et al. Effects of intravenous fentanyl around the end of surgery on emergence agitation in children: Systematic review and meta-analysis[J]. *Paediatr Anaesth*, 2017, 27(9): 885-892
- [16] Marouf HM. Effect of Pregabalin Premedication on Emergence Agitation in Children after Sevoflurane Anesthesia: A Randomized Controlled Study[J]. *Anesth Essays Res*, 2018, 12(1): 31-35
- [17] 章晓慧.儿童全身麻醉苏醒期躁动研究进展[J].*国际儿科学杂志*, 2017, 44(6): 404-408
- [18] Kanaya A. Emergence agitation in children: risk factors, prevention, and treatment[J]. *J Anesth*, 2016, 30(2): 261-267
- [19] Torres-Andres F, Fink EL, Bell MJ, et al. Survival and Long-Term Functional Outcomes for Children With Cardiac Arrest Treated with Extracorporeal Cardiopulmonary Resuscitation [J]. *Pediatr Crit Care Med*, 2018, 19(5): 451-458
- [20] 王娟,白雪.细节护理对低体重先心病患儿的护理效果及生活质量的影响[J].*中国医药导报*, 2017, 14(23): 171-174
- [21] Kim KM, Lee KH, Kim YH, et al. Comparison of effects of intravenous midazolam and ketamine on emergence agitation in children: Randomized controlled trial[J]. *J Int Med Res*, 2016, 44(2): 258-266
- [22] Kim NY, Kim SY, Yoon HJ, et al. Effect of dexmedetomidine on sevoflurane requirements and emergence agitation in children undergoing ambulatory surgery[J]. *Yonsei Med J*, 2014, 55(1): 209-215
- [23] Vadivelu N, Schermer E, Kodumudi V, et al. Role of ketamine for analgesia in adults and children [J]. *J Anaesthesiol Clin Pharmacol*, 2016, 32(3): 298-306
- [24] Golding CL, Miller JL, Gessouroun MR, et al. Ketamine Continuous Infusions in Critically Ill Infants and Children [J]. *Ann Pharmacother*, 2016, 50(3): 234-241
- [25] 潘守东,韩丁,罗毅,等.七氟醚或氯胺酮麻醉诱导对法洛四联症患者血流动力学的影响[J].*临床麻醉学杂志*, 2016, 32(11): 1076-1079
- [26] Ibrahim TH, Abdelrahman HS, Alharbi MA, et al. Effect of ketamine on pro- and anti-inflammatory cytokine response in paediatric cardiac surgery: A prospective randomised controlled study [J]. *Indian J Anaesth*, 2017, 61(7): 549-555
- [27] Tokuwaka J, Satsumae T, Mizutani T, et al. The relationship between age and minimum alveolar concentration of sevoflurane for maintaining bispectral index below 50 in children [J]. *Anaesthesia*, 2015, 70(3): 318-322
- [28] Wang CH, Luo J, Li J, et al. Efficacy of inhalational sevoflurane anesthesia induction on inhibiting the stress response to endotracheal intubation in children with congenital heart disease [J]. *Eur Rev Med Pharmacol Sci*, 2018, 22(4): 1113-1117
- [29] 钟贤春,石鸿金.右美托咪定对保留自主呼吸七氟烷麻醉唇腭裂手术患儿苏醒期的影响[J].*河北医药*, 2018, 40(5): 739-741
- [30] Wang JK, Wu HF, Zhou H, et al. Postconditioning with sevoflurane protects against focal cerebral ischemia and reperfusion injury involving mitochondrial ATP-dependent potassium channel and mitochondrial permeability transition pore[J]. *Neurol Res*, 2015, 37(1): 77-83