

doi: 10.13241/j.cnki.pmb.2020.11.034

## 超声引导下不同 TPV 对单孔胸腔镜肺癌根治术患者 MCP-1、PGE2 等指标的影响\*

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**摘要 目的:**探讨超声引导下不同胸椎旁神经阻滞(thoracic paravertebral nerve block, TPVB)对单孔胸腔镜肺癌根治术患者巨噬细胞趋化蛋白-1(monocyte chemotactic protein-1, MCP-1)、血浆前列腺素 E-2(prostaglandin E-2, PGE 2)等指标的影响。**方法:**选择我院 2016 年 1 月至 2019 年 12 月收治的 96 例择期行单孔胸腔镜的肺癌根治术患者, A 组采用全身麻醉+自控静脉镇痛法, B 组采用全麻+单次 TPVB+自控静脉镇痛方法, C 组采用全麻+连续 TPVB 麻醉法, 对比三组的不同时间点的动脉血氧分压(partial arterial oxygen pressure, PaO<sub>2</sub>)、动脉二氧化碳分压(arterial carbon dioxide partial pressure, PaCO<sub>2</sub>)、肺泡动脉血氧分压差(difference of alveolar arterial oxygen partial pressure, P<sub>A-a</sub>O<sub>2</sub>)、1 秒用力呼气容量(1 second forced expiratory volume, FEV<sub>1</sub>)、用力肺活量(forced vital capacity, FVC)、最大呼气中段流量(maximum expiratory flow, MMF)等。**结果:**T3 及 T4 点时, 三组的 PaO<sub>2</sub>、FEV<sub>1</sub>、FVC、MMF 较 T0 点明显降低, 三组以上指标水平为 A 组 < B 组 < C 组, P<sub>A-a</sub>O<sub>2</sub> 较 T0 点明显升高, 为 A 组 > B 组 > C 组 (P<0.05)。三组的 MCP-1、PGE2 及 TNF-α 水平在 T0 点时对比无差异 (P>0.05), T3、T4 点时, 三组以上指标明显上升, A 组 > B 组 > C 组 (P<0.05)。**结论:**全麻联合 TPVB 超声引导下连续 TPBV 法可改善患者的肺功能, 促进肺部氧合, 可能与其可对患者炎性指标影响较小有关。

**关键词:**超声引导; TPBV; 单孔胸腔镜肺癌根治术; 肺功能

**中图分类号:**R734.2 **文献标识码:**A **文章编号:**1673-6273(2020)11-2156-04

## The Effects of Different TPBV on McP-1, PGE2 and Other Indicators in Patients Undergoing Single-port Thoracoscopic Radical Resection of Lung Cancer Under Ultrasound Guidance\*

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**ABSTRACT Objective:** To investigate the effects of different TPBV on MCP-1, PGE2 and other indicators in patients undergoing single-port thoracoscopic radical resection of lung cancer under ultrasound guidance. **Methods:** 96 cases admitted to our hospital from January 2016 to December 2019 who underwent elective single-orifice thoracoscopic radical resection of lung cancer were selected, group A were given general anesthesia+controlled intravenous analgesia, group B were given general anesthesia+ single TPVB+controlled intravenous analgesia, group C were given general anesthesia + continuous TPVB. The levels of PaO<sub>2</sub>, PaCO<sub>2</sub>, P<sub>A-a</sub>O<sub>2</sub>, FEV<sub>1</sub>, FVC, MMF. **Results:** At T3 and T4, the PaO<sub>2</sub>, FEV<sub>1</sub>, FVC and MMF in three groups were significantly lower than that of T0, and the index levels of three groups were group A<group B<group C, P<sub>A-a</sub>O<sub>2</sub> was significantly higher than T0, group A>group B>group C (P<0.05). The levels of MCP-1, PGE2, and TNF-α in the three groups were not statistically significant at the T0 point (P>0.05). At the T3, T4 points, the above three indicators were more than T0 The points increased significantly, and the comparison of the three groups was statistically significant at the same time point of T3, T4, group A>group B> group C (P<0.05). **Conclusion:** General anesthesia combined with TPVB ultrasound-guided continuous TPBV can improve patients' lung function and promote lung oxygenation, which may be related to their less impact on patients' stress and inflammatory indexes.

**Key words:** Ultrasonic guidance; TPBV; Single-orifice thoracoscopic radical resection of lung cancer; Lung function

**Chinese Library Classification (CLC):** R734.2 **Document code:** A

**Article ID:** 1673-6273(2020)11-2156-04

### 前言

肺癌的首选治疗方法是胸外科手术,随着医学技术的不断进步及人们对手术要求的提高,术后如何快速康复已成为临床的研究热点<sup>[1]</sup>,快速康复与患者机体受到的应激刺激密切相关,在麻醉、手术侵袭、术后疼痛侵袭下患者的交感神经兴奋及垂

体-肾上腺皮质分泌增多,出现强烈应激反应,不利于术后康复,因此通过选择合适的麻醉方式或麻醉用药减轻应激刺激,促进患者术后康复更有实际意义<sup>[2-4]</sup>。单孔胸腔镜肺癌根治术在胸部只有 1 个操作孔(第 4 肋间胸大肌后缘及背阔肌前缘间)及观察孔(腋前线及腋中线第 8 肋间),具有创伤小、患者术后恢复快等有点<sup>[5,6]</sup>,以往单孔胸腔镜肺癌根治术多采用全麻+自

\* 基金项目:国家自然科学基金项目(81302153)

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(收稿日期:2020-01-23 接受日期:2020-02-18)

控镇痛的方法,而镇痛及麻醉效果不佳,不利于患者术后康复转归<sup>[7,8]</sup>;超声引导下胸椎旁神经阻滞(Thoracic paravertebral block, TPVB)可通过肋间神经背支、肋间神经(脊神经前支)、肋间神经交通支、腹支及交感干的伤害性刺激进行阻断,从而产生麻醉、镇痛效果<sup>[9,10]</sup>,本文分析了不同 TPBV 方法对单孔胸腔镜肺癌根治术患者的麻醉效果,并分析了其作用机制,以为单孔胸腔镜肺癌根治术选择合适的麻醉方式提供依据。

## 1 资料与方法

表 1 三组一般资料对比

Table 1 The general data comparison in three groups

Groups	n	Gender		Average age (Year)	Average BMI (kg/m <sup>2</sup> )	Pathologic types		
		Male	Female			Squamous cell carcinomas	Adenocarcino- ma	Gland scale cancer
A	31	18	13	58.7± 4.1	22.7± 2.0	15	15	1
B	33	19	14	59.1± 4.4	22.9± 2.2	16	16	1
C	321	19	13	58.8± 4.5	23.1± 2.4	17	14	1

### 1.2 方法

患者入室后均建立静脉通路,对心率、血压、血氧进行常规监测。

A 组采用全身麻醉+自控静脉镇痛法,麻醉诱导:给予患者 0.05 mg 咪达唑仑、0.5 μg/kg 舒芬太尼、2 mg/kg·min 异丙酚、1 mg/kg 罗库溴铵,之后行气管插管,维持呼气末二氧化碳在 35~45 mmHg;麻醉维持:靶控输注丙泊酚及瑞芬太尼,丙泊酚血浆靶浓度为 2~3 μg/mL,瑞芬太尼的效应室靶浓度为 2~3 ng/mL,再间断追加舒芬太尼及阿曲库铵,维持脑电双频指数在 40~60 间;术后给予患者静脉自控镇痛,给予 1 μg/(kg·d)舒芬太尼及 5 mg 托烷司琼,背景剂量为 2 mL/h,负荷剂量为 2 mL,单次剂量为 2 mL,锁定时间为 15 min,维持 48 h。

B 组给予全麻+单次 TPVB+自控静脉镇痛方法,术前穿刺右侧内静脉,置管后监测中心静脉压,穿刺桡动脉后行有创血压监测,在患者麻醉诱导前注射 2 mg 咪达唑仑、5 mg 舒芬太尼,之后行超声引导下进行胸椎旁阻滞,患者取侧卧位,之后弓背屈曲,消毒后采用超声对 T5 椎旁间隙进行定位,用长度为 15 cm、18 G 的穿刺针与生理盐水注射器进行连接,穿刺点为 T5 棘突下缘旁开 3 cm,之后用平面内的穿刺法,用平面内穿刺法穿刺至椎旁间隙,待回抽无血后,注入 1 mL 生理盐水,之后缓慢注入 20 mL 0.5%罗哌卡因,再将穿刺针拔出,待 TPVB 后检测阻滞平面。麻醉诱导:依次静脉注入 0.08~0.1 mg/kg 咪达唑仑、0.1~0.3 mg/kg 依托咪酯、0.1~0.15 mg/kg 顺苯磺酸阿曲库铵、0.4~0.6 μg/kg 舒芬太尼,之后行气管插管,维持呼气末二氧化碳在 30~35 mmHg,之后静脉把控输注瑞芬太尼(0.1~0.3 μg/kg·min)及丙泊酚(2~4 μg/mL),再间断给予咪达唑仑、舒芬太尼、顺阿曲库铵,吸入七氟醚,维持脑电双频指数在 40~60 间,术后连接镇痛泵行自控静脉镇痛,给予 1 μg/(kg·d)舒芬太尼及 5 mg 托烷司琼,背景剂量为 2 mL/h,负荷剂量为 2 mL,单次剂量为 2 mL,锁定时间为 15 min,维持 48 h。

C 组给予全麻+连续 TPVB 麻醉法,超声引导下穿刺方法同 B 组,穿刺后经穿刺针置入硬膜外导管,经导管注入 20 mL 0.5%罗哌卡因,之后退针,并固定导管。麻醉诱导及麻醉维持在 B 组方法基础上,在置管后即刻连接镇痛泵,以 5 mL/h 的速

### 1.1 一般资料

选择我院 2016 年 1 月至 2019 年 12 月收治的 96 例择期行单孔胸腔镜的肺癌根治术患者,纳入标准:均经病理诊断确诊为肺癌,ASA 为 I~II 级,排除严重肝脏、心脏、肾脏疾病者、神经精神系统疾病史者、胸廓畸形者、脊柱畸形者、分为 3 组,三组一般资料对比无差异( $P>0.05$ ),见表 1。本研究所有患者知情同意,且经医院伦理委员会批准同意。

度持续泵注 0.2%罗哌卡因进行胸旁神经阻滞。

三组术后待患者生命体征稳定后,拔除气管导管,之后吸入 25%氧气。

### 1.3 观察指标

(1)采用血气分析仪检测三组患者入室后(T0)、术后 24 h(T3)、术后 48 h(T4)的 PaO<sub>2</sub>、PaCO<sub>2</sub> 及 P<sub>Aa</sub>O<sub>2</sub> 水平;(2)分别在 T0、T3、T4 点抽取患者 8 mL 肘静脉血,2000 r/min 速度下离心 5 min,采用酶联免疫吸附法检测三组 MCP-1、PGE 2 及 TNF-α 水平;(3)采用肺功能检测仪测定患者 T0、T3、T4 点的 FEV1、FVC、MMF。

### 1.4 统计学方法

采用 SPSS23.0 软件,计数资料或计量资料分别用频数或  $\bar{x} \pm s$  表示,用卡方检验或方差分析对比分析, $P<0.05$  有统计学意义。

## 2 结果

### 2.1 三组不同时间 PaO<sub>2</sub>、PaCO<sub>2</sub> 及 P<sub>Aa</sub>O<sub>2</sub> 水平

三组在 T0、T3、T4 点的 PaCO<sub>2</sub> 水平对比无差异( $P>0.05$ ),三组在 T0 点的 PaO<sub>2</sub> 与 P<sub>Aa</sub>O<sub>2</sub> 对比无差异( $P>0.05$ );T3 点及 T4 点时,三组的 PaO<sub>2</sub> 明显降低,P<sub>Aa</sub>O<sub>2</sub> 明显升高,同时 T3 点与 T4 点时三组的 PaO<sub>2</sub> 水平为 A 组 <B 组 <C 组, P<sub>Aa</sub>O<sub>2</sub> 水平为 A 组 >B 组 >C 组( $P<0.05$ ),见表 2。

### 2.2 对比三组不同时间 FEV<sub>1</sub>、FVC、MMF 水平

三组在 T0 点的 FEV<sub>1</sub>、FVC、MMF 对比无差异( $P>0.05$ );T3 点及 T4 点时,三组的上述指标明显降低,同时 T4 点与 T5 点时三组上述指标 A 组 <B 组 <C 组( $P<0.05$ ),见表 3。

### 2.3 对比三组不同时间 MCP-1、PGE2 及 TNF-α 水平

三组的 MCP-1、PGE2 及 TNF-α 水平在 T0 点时对比无差异( $P>0.05$ );T3 点时,三组以上指标明显上升,T4 点时三组上述指标显著降低,且组间 A 组 >B 组 >C 组( $P<0.05$ ),表 4。

## 3 讨论

TPVB 可对胸部、上腹部前壁、后壁、侧壁神经传导进行阻止,从而产生麻醉及镇痛效果,随着医学技术的不断发展,

表 2 三组不同时间 PaO<sub>2</sub>、PaCO<sub>2</sub> 及 PA-aO<sub>2</sub> 水平 (mmHg,  $\bar{x} \pm s$ )

Table 2 The PaO<sub>2</sub>, PaCO<sub>2</sub> and PA-aO<sub>2</sub> levels at three different times (mmHg,  $\bar{x} \pm s$ )

Time	PaO <sub>2</sub>			PaCO <sub>2</sub>			P <sub>A-a</sub> O <sub>2</sub>		
	A	B	C	A	B	C	A	B	C
T0	91.2± 4.1	91.7± 4.3	91.0± 5.0	40.7± 6.2	40.5± 6.4	40.7± 5.9	14.2± 3.1	14.3± 3.4	14.5± 3.0
T3	64.9± 5.7*	67.2± 6.1* <sup>#</sup>	74.1± 7.5* <sup>#&amp;</sup>	41.2± 7.2	40.9± 6.6	41.0± 6.7	46.8± 4.2*	43.1± 4.1* <sup>#</sup>	38.9± 5.0* <sup>#&amp;</sup>
T4	75.3± 7.9*	78.1± 8.2* <sup>#</sup>	82.9± 6.9* <sup>#&amp;</sup>	41.6± 7.6	41.0± 6.9	41.1± 6.9	36.4± 5.4*	33.8± 4.9* <sup>#</sup>	27.8± 5.8* <sup>#&amp;</sup>

Note: Compared with T0 in the same group, \*P<0.05; compared with group A, <sup>#</sup>P<0.05; compared with group B, & P<0.05.

表 3 对比三组 T0、T3、T4 点的 FEV<sub>1</sub>、FVC、MMF ( $\bar{x} \pm s$ )

Table 3 The FEV<sub>1</sub>, FVC, MMF level in three groups at T0, T3 and T4 ( $\bar{x} \pm s$ )

Time	FEV <sub>1</sub> (L)			FVC(L)			MMF(L/s)		
	A	B	C	A	B	C	A	B	C
T0	2.9± 0.7	3.0± 0.7	2.9± 0.8	3.6± 0.7	3.7± 0.8	3.6± 0.8	2.5± 0.6	2.4± 0.7	2.5± 0.7
T3	1.5± 0.4*	1.8± 0.5* <sup>#</sup>	2.2± 0.6* <sup>#&amp;</sup>	1.8± 0.4*	2.2± 0.6* <sup>#</sup>	2.4± 0.6* <sup>#&amp;</sup>	0.9± 0.2	1.5± 0.4* <sup>#</sup>	1.7± 0.6* <sup>#&amp;</sup>
T4	1.9± 0.5*	2.3± 0.6* <sup>#</sup>	2.5± 0.7* <sup>#&amp;</sup>	2.1± 0.5*	2.5± 0.6* <sup>#</sup>	2.9± 0.7* <sup>#&amp;</sup>	1.4± 0.5*	1.8± 0.5* <sup>#</sup>	2.0± 0.6* <sup>#&amp;</sup>

表 4 对比三组 T0、T3、T4 的 MCP-1、PGE2 及 TNF-α 水平 ( $\bar{x} \pm s$ , pg/mL)

Table 4 The MCP-1, PGE2 and TNF-α level in three groups at T0, T3, T4 ( $\bar{x} \pm s$ , pg/mL)

Time	MCP-1			PGE2			TNF-α		
	A	B	C	A	B	C	A	B	C
T0	13.5± 3.1	13.6± 3.2	13.4± 3.9	210.7± 21.8	211.1± 22.4	211.8± 23.1	21.8± 4.5	22.0± 4.7	22.3± 5.0
T3	72.1± 7.9*	64.9± 6.8* <sup>#</sup>	52.1± 7.9* <sup>#&amp;</sup>	371.9± 40.5*	360.7± 45.1* <sup>#</sup>	340.7± 46.1* <sup>#&amp;</sup>	55.2± 6.0*	47.9± 6.2* <sup>#</sup>	37.8± 5.0* <sup>#&amp;</sup>
T4	60.9± 9.9*	51.8± 8.9* <sup>#</sup>	40.8± 7.6* <sup>#&amp;</sup>	352.1± 38.7*	331.8± 44.9* <sup>#</sup>	311.2± 41.2* <sup>#&amp;</sup>	49.9± 6.2*	41.0± 4.8* <sup>#</sup>	33.7± 4.8* <sup>#&amp;</sup>

TPVB 联合全麻可用于胸腔镜手术中<sup>[11,12]</sup>,而以往传统的 TPVB 手术操作多通过体表解剖定位来寻找确定目标神经,从而增加了患者气胸及疼痛的风险<sup>[13,14]</sup>,而超声引导下 TPVB 对穿刺靶点周围的结构及重要组织可产生可视化效果,从而避开障碍物,使穿刺针斜面更加接近神经分布区域,从而更加保证局部的麻醉药可准确分布于椎旁间隙中<sup>[15-17]</sup>。而临床实践发现超声引导下 TPVB 在乳腺癌根治术时单次注射与连续注射两种方法均可使用<sup>[18,19]</sup>,二者对手术的麻醉、镇痛效果不同,而其在单孔胸腔镜肺癌根治术的研究较少,本文对此进行了分析。

本文结果显示,三组在 T0、T3、T4 点的 PaCO<sub>2</sub> 水平对比无统计学意义,三组在 T0 点的 PaO<sub>2</sub>、P<sub>A-a</sub>O<sub>2</sub>、FEV<sub>1</sub>、FVC、MMF 对比无统计学意义,T3 点及 T4 点时,三组的 PaO<sub>2</sub>、FEV<sub>1</sub>、FVC、MMF 明显降低 A 组 < B 组 < C 组, P<sub>A-a</sub>O<sub>2</sub> 明显升高 A 组 > B 组 > C 组;表明全麻联合 TPVB 超声引导下连续 TPBV 法可提高单孔胸腔镜肺癌根治术后肺功能及氧合功能,主要是由于其在全麻时同时应用了连续椎旁神经阻滞,可降低胸壁肌肉张力,增加胸壁顺应性,阻滞来自内脏传入及躯干、胸段脊神经后根的抑制性反射,从而降低机体中枢对患者膈肌的抑制,阻断疼痛信息于神经元水平,降低不良信号向患者的高级中枢扩散,对炎症介质释放产生抑制作用,同时其可降低机体气道阻力,提高了呼吸功能<sup>[20-24]</sup>;再次胸椎旁神经阻滞可对伤害性刺激导入机体引起神经内分泌改变及炎症介质释放产生了抑制作用,同时阻滞机体的节前交感神经,产生更好的麻醉及镇痛效果,改变肺血管张力,从而改善机体的肺微循环灌注,提高了肺功能及氧合功能<sup>[25]</sup>,单一 TPBV 法结果与 Xu J<sup>[26]</sup>等研究相似,而本研究采用连续 TPBV 法表明连续 TPBV 法的结果较好,主要

是由于连续 TPBV 法可持续给予患者局部麻醉,降低了手术机体的应激反应。

PGE 2 是由环氧合酶 2 对花生四烯酸产生催化产生的一种疼痛介质,其高表达可降低机体痛觉阈值,从而增加了患者的主观疼痛感<sup>[27,28]</sup>,MCP-1 是由单核细胞分泌的一种炎症趋化因子,TNF-α 是早期的炎症因子,在机体受创时,其水平会异常升高<sup>[29,30]</sup>,参与机体的炎症过程。本文结果表明,三组 MCP-1、PGE 2 及 TNF-α 水平在 T0 点时对比无差异,T3、T4 点时,三组以上指标明显上升,且 A 组 > B 组 > C 组,表明全麻联合 TPVB 超声引导下连续 TPBV 法可提高单孔胸腔镜肺癌根治术后的炎症因子影响较小,从而使得其镇痛效果均优于其他两种方法,对肺功能及氧合功能影响较小。

综上所述,全麻联合 TPVB 超声引导下连续 TPBV 法可改善患者的肺功能,促进肺部氧合,可能与其对患者的炎症因子影响较小有关。本研究样本量较小,其对患者的痛阈未进行研究,有待进行下一步深入分析。

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