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随机对照试验比较连续收肌管阻滞联合前路坐骨神经阻滞或局部浸润对全膝关节置换术后的镇痛效果

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[摘要] 目的: 探讨超声引导下连续收肌管阻滞联合前路坐骨神经阻滞用于全膝关节置换患者术后的镇痛效果和不良反应。方法: 择期全麻下初次行单侧全膝关节置换术(total knee arthroplasty, TKA)患者80例, 美国麻醉医师协会(American Society of Anesthesiologists, ASA)分级I~II级, 年龄55~75岁, 体重50~85 kg, 性别不限, 采用随机数字表法分为连续收肌管阻滞联合前路坐骨神经阻滞组(A组)和连续收肌管阻滞联合局部浸润组(B组), 每组各40例。A组于全身麻醉诱导前行连续收肌管阻滞及前路坐骨神经阻滞, B组于全身麻醉诱导前行连续收肌管阻滞, 置入假体时实施膝关节局部浸润。记录离室时、术后3, 6, 24, 48及72 h静态和动态视觉模拟评分法(Visual Analogue Scale, VAS)评分, 术后24, 48, 72 h及1周膝关节活动度和股四头肌肌力及48 h不良反应发生情况。结果: 术后3, 6, 24, 72 h时, A组静息痛VAS评分小于B组, 差异有统计学意义($P<0.05$); 术后3, 6, 24 h运动痛VAS评分小于B组, 差异有统计学意义($P<0.05$)。术后48 h膝关节活动度A组大于B组, 差异有统计学意义($P<0.05$), 两组术后24, 72 h及术后1周膝关节活动度差异无统计学意义($P>0.05$)。A组有7例出现呕吐, B组有15例出现呕吐, 差异有统计学意义($P<0.05$)。结论: 连续收肌管阻滞联合前路坐骨神经阻滞对TKA患者术后镇痛效果显著, 术后并发症少, 有利于患者早期功能锻炼和康复。

[关键词] 收肌管; 坐骨神经; 神经阻滞; 镇痛; 全膝关节置换术

Continuous adductor canal block combined with anterior sciatic nerve block versus continuous adductor canal block combined with local infiltration analgesia for pain relief after total knee arthroplasty: A randomized controlled trial

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Abstract **Objective:** To investigate the effects of ultrasound-guided continuous adductor canal block (CACB) combined

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with anterior sciatic nerve block (SNB) versus CACB combined with local infiltration anesthesia (LIA) for postoperative analgesia in the patients undergoing total knee arthroplasty. **Methods:** Eighty patients with elective unilateral total knee arthroplasty, aged 55–75 years, weighed 50–85 kg, American Society Anesthesiologists physical status I–II, were divided into group A (CACB combined with SNB group) and group B (CACB combined with LIA group), 40 patients in each group. Ultrasound adductor canal block and sciatic nerve block were performed with 0.5% ropivacaine 20 mL before induction in group A. Ultrasound adductor canal block were performed with 0.5% ropivacaine 20 mL before induction and after installation of the knee prosthesis, local infiltration anesthesia was conducted with 0.2% ropivacaine 50 mL around the knee joint. At 0, 3, 6, 24, 48, 72 h after surgery, Visual Analogue Scale (VAS) score at rest and during activity were recorded, at 24, 48, 72 h, 1 week after surgery the quadriceps strength and active range of knee flexion was measured. The requirement for analgesic drugs and development of adverse reactions was recorded. **Results:** At 3, 6, 24 and 72 h after the surgery, there were significant differences ($P < 0.05$) on the VAS score at rest between the two groups. The VAS scores during activity decreased significantly at 3, 6, and 24 h after surgery ($P < 0.05$). The knee joint mobility at 48 h after operation in group A was greater than that in group B ($P < 0.05$). There was significant difference between the two groups in postoperative 72-hour quadriceps strength ($P < 0.05$), and there was no significant difference in the quadriceps strength in the rest of the period ($P > 0.05$). Seven patients in group A had vomiting, and 15 patients in group B had vomiting. The difference was significant ($P < 0.05$). **Conclusion:** Continuous adductor canal block combined with anterior sciatic nerve block is beneficial for early functional rehabilitation, which has a significant effect on postoperative analgesia in patients with total knee arthroplasty, and has fewer postoperative complications.

Keywords adductor canal; sciatic nerve; nerve block; analgesia; total knee arthroplasty

据统计数据^[1]显示：全球膝关节退行性炎患病率女性为4.8%，男性为2.8%。全膝关节置换术(total knee arthroplasty, TKA)是目前治疗膝关节退行性关节炎最有效的方法。但术后患者常经历中重度到重度的疼痛，导致患侧膝关节活动受限，影响早期康复锻炼并增加术后住院时间和费用^[2]。因此，术后疼痛的管理对于术后康复至关重要。研究^[3]指出：股神经阻滞(femoral nerve block, FNB)是目前TKA术后最常用的神经阻滞方法，镇痛效果满意，但是会导致术后股四头肌肌力降低^[4-5]。而且，有2/3的患者仍感到膝关节后方疼痛^[6]。坐骨神经阻滞(sciatic nerve block, SNB)和局部浸润麻醉是补充股神经阻滞TKA后镇痛不足的两种主要方法^[7-8]。收肌管内有隐神经，唯一的纯感觉神经。收肌管阻滞可达到与股神经阻滞相似的镇痛效果^[9-11]，但对股四头肌肌力影响较小，有利于患者的早期功能锻炼^[5,10,12-14]。本研究拟对比连续收肌管阻滞联合前路坐骨神经阻滞或局部浸润镇痛用于TKA手术患者术后镇痛效果、肌力状况、关节活动度及术后不良反应，为临床选择提供理论基础。

1 对象与方法

1.1 对象

本研究获医院伦理委员会批准，并与患者或家属签署知情同意书。择期全麻下初次行单侧TKA患者80例，年龄55~75岁，体重50~85 kg，美国麻醉医师协会(American Society of Anesthesiologists, ASA)分级I~II级。无中枢神经系统及外周神经疾病，无阻滞部位感染，无注射药物过敏史，无药物依赖史，无肝、肾功能不全，无精神疾病病史。采用随机数字表法，将患者分为连续收肌管阻滞联合前路坐骨神经阻滞组(A组)、连续收肌管阻滞联合局部浸润组(B组)，每组各40例。

1.2 方法

入院后即进行疼痛宣教及疼痛评分培训。术前3 d开始口服塞来昔布0.2 g/次，2次/d。术前1 d访视再次对患者进行疼痛宣教及疼痛评分培训，并记录患肢股四头肌肌力、膝关节疼痛程度。

所有患者入室后开放静脉通路，常规监测心

电图、无创动脉血压, 脉搏血氧饱和度、呼气末二氧化碳分压、脑电双频指数。轻度镇静镇痛后进行神经阻滞操作。A组: 患者平卧位, 穿刺点及周围皮肤常规消毒铺巾。采用MicroMaxx便携式超声(美国SonoSite公司), 将无菌耦合剂涂于探头并用无菌保护套隔离。使用高频线阵探头, 在大腿中间(髌骨上边界至腹股沟韧带连线中点)靠内侧, 股动脉外侧缝匠肌深面垂直于探头进针, 针尖抵达一近三角形高回声区域内后, 回抽无血, 注入0.5%的罗哌卡因(瑞典AstraZeneca公司, 批号: NAVU)20 mL。经神经阻滞针置入导管, 留置导管深度7~9 cm至皮肤, 妥善固定。使用低频凸阵超声探头垂直于皮肤距离腹股沟皮肤皱褶大约8 cm, 在股骨小转子的后内侧获得坐骨神经横断面高回声图像, 神经阻滞针连接神经刺激仪穿刺针平行于探头, 从大腿的前内侧向后外侧穿刺, 神经刺激仪初始电流设为1 mA, 频率2 Hz, 缓慢进针, 出现足部跖屈或背屈时, 调整穿刺针的位置使刺激仪电流减小至0.5 mA运动仍存在, 回抽无血, 注入0.5%罗哌卡因20 mL, 并调节针尖位置使局麻药包绕神经扩散。B组: 连续收肌管阻滞方法同A组, 手术即将结束时行关节腔周围局部浸润: 假体置入前(膝关节后关节囊和内外侧副韧带), 假体置入后(髌韧带和股四头肌)和缝合前(脂肪和皮下组织)各部位分别注射0.2%罗哌卡因10 mL, 共50 mL。用药后10 min分别采用酒精棉签测试患侧大腿下1/3段前区(隐神经支配区域)、后区(坐骨神经支配区域)的温度觉和轻触觉, 出现温度觉或轻触觉减退为阻滞成功标准。所有患者下肢神经阻滞由同一位资深麻醉科医生完成。

麻醉诱导: 依次静脉注射咪达唑仑(Midazolam, 江苏恩华药业股份有限公司, 批号: 20171204)0.03 mg/kg、异丙酚(Propofol, 四川国瑞药业有限责任公司, 批号: 1702243)1.0~1.5 mg/kg、舒芬太尼(Sufentanil, 宜昌人福药业有限责任公司, 批号: 1171205 A1)0.3~0.5 $\mu\text{g}/\text{kg}$ 和苯磺顺阿曲库铵[Cisatracurium Besilate, 上药东英(江苏)药业有限公司, 批号: A11171108]0.2~0.3 mg/kg, 插入合适喉罩后行机械通气, 潮气量(tidal volume, VT)8~10 mL/kg, 通气频率12~14 min^{-1} , 吸呼比1:2, 调整通气参数, 维持 ETCO_2 30~40 mmHg (1 mmHg=0.133 kPa)。麻醉维持: 吸入1%~3%七氟醚, 静脉输注瑞芬太尼(Remifentanil, 江苏恩华药业股份有限公司, 批号: 20170102) 0.05~0.15 $\mu\text{g}/(\text{kg}\cdot\text{min}^{-1})$ 和异丙酚4.0~8.0 $\text{mg}/(\text{kg}\cdot\text{h}^{-1})$, 间断静脉注射顺苯磺酸阿曲库铵0.15 mg/kg, 调

整异丙酚的输注速率, 维持脑电双频指数40~60, 根据HR和BP调整瑞芬太尼的输注速率, 必要时使用血管活性药物以维持BP和HR平稳, 使其波动幅度不超过基础水平的20%, 术中膝关节假体安装完后, 关闭七氟醚, 改为丙泊酚, 瑞芬太尼持续泵入, 缝皮时停用麻醉药。待患者自主呼吸恢复, 潮气量 $>6 \text{ mL}/\text{kg}$, 呼吸频率12~20 min^{-1} 时, 拔除喉罩, 生命体征平稳后送往麻醉恢复室观察, 麻醉恢复期结束后送返病房, 进行统一术后管理。术毕连接并启动镇痛泵(浙江苏嘉医疗器械股份有限公司) 0.2%罗派卡因5 mL/h, 追加每次给药0.5 mL, 锁定时间为15 min, 术后连续泵注2 d。记录手术时间及术中麻醉药物用量。术后所有患者均不使用静脉镇痛泵。术后第1天开始予以口服塞来昔布0.2 g, 2次/d, 术后1 d即开始鼓励患者作膝关节屈伸锻炼, 并尽早下地活动。

术后采用视觉模拟评分法(Visual Analogue Scale, VAS)评估患者疼痛程度, 0~10分, 分值越高疼痛越严重。记录离复苏室时、术后3, 6, 24, 48, 72 h静态和动态时(膝关节被动弯曲45°时)的VAS评分。若患者术后出现膝关节疼痛VAS评分 ≥ 4 , 按压镇痛泵。疼痛仍未得到缓解者, 予以曲马多针100 mg肌注补救镇痛。记录48 h内镇痛泵有效按压次数和曲马多补救镇痛用量, 术后24, 48, 72 h及1周患侧膝关节活动度。记录术后48 h内恶心呕吐、头昏、嗜睡、呼吸抑制、局麻药中毒、神经损伤等相关不良反应发生情况。

1.3 统计学处理

采用SPSS 19.0统计学软件进行分析。正态分布的计量资料以均数 \pm 标准差($\bar{x}\pm s$)表示, 组间比较采用 t 检验。偏态分布的计量资料以中位数(四分位数间距)[$M(Q)$]表示, 组间比较采用秩和检验。计数资料比较采用 χ^2 检验。 $P<0.05$ 为差异有统计学意义。

2 结果

两组一般情况及手术时间比较差异无统计学意义($P>0.05$, 表1)。

两组术前静息痛、活动痛的VAS评分差异无统计学意义($P>0.05$), 术后3, 6, 24, 72 h A组的静息痛VAS评分小于B组, 差异有统计学意义($P<0.05$)。离室时、术后48 h两组患者静息痛的VAS评分差异无统计学意义($P>0.05$, 表2)。离室时、术后3, 6, 24 h运动痛VAS评分小于B组, 差异有统计学意义($P<0.05$)。术后48, 72 h两组运动

痛的VAS评分差异无统计学意义($P>0.05$, 表3)。两组术后均未按压止痛泵, 未追加曲马多。

两组术后72 h股四头肌力B组大于A组, 差异有统计学意义($P<0.05$), 其余各时段股四头肌力差异无统计学意义($P>0.05$, 表4)。术后48 h膝关节活动度A组大于B组, 差异有统计学意义($P<0.05$), 其余各时间段膝关节活动度差异无统计

学意义($P>0.05$, 表4)。

两组术中及术后均未出现严重的并发症。A组患者均有7例出现呕吐, B组患者有15例出现呕吐, 差异有统计学意义($P<0.05$)。两组恶心呕吐未行特殊处理均好转。两组患者均未出现谵妄、呼吸抑制、神经损伤、局麻药中毒等并发症, 无深静脉血栓、肺栓塞等并发症。

表1 两组一般情况及手术时长的比较($n=40$)

Table 1 Comparison of general date and surgery time between the 2 groups ($n=40$)

组别	年龄/岁	性别(男/女)	BMI/($\text{kg}\cdot\text{m}^{-2}$)	ASA分级情况(I/II)	合并高血压比率/%	手术时间/min
A组	64.6 ± 3.8	7/33	27.8 ± 2.5	2/38	11/40	111.0 ± 13.7
B组	64.8 ± 3.7	6/34	26.9 ± 2.4	3/37	15/40	108.2 ± 12.4

表2 两组静息痛VAS评分比较($n=40$)

Table 2 Comparison of VAS score of pain at rest between the 2 groups ($n=40$)

组别	术前	术后VAS评分					
		离室时	3 h	6 h	24 h	48 h	72 h
A组	0.990 ± 1.146	1.555 ± 0.715	1.555 ± 0.715	1.430 ± 0.747	1.000 ± 0.650	0.760 ± 0.750	0.290 ± 0.455
B组	1.410 ± 1.012	2.369 ± 0.527	2.005 ± 0.485	1.920 ± 0.598	1.550 ± 0.733	1.360 ± 0.899	0.870 ± 0.825
P	0.407	0.073	0.005	0.017	0.046	0.233	<0.001

表3 两组运动痛VAS评分比较($n=40$)

Table 3 Comparison of VAS score of pain during activity between the 2 groups ($n=40$)

组别	术前	术后VAS评分					
		离室时	3 h	6 h	24 h	48 h	72 h
A组	5.963 ± 0.9634	2.793 ± 1.5539	3.100 ± 1.505	2.897 ± 1.4150	2.510 ± 1.222	1.800 ± 1.381	1.380 ± 1.148
B组	6.064 ± 1.0271	4.154 ± 0.9156	4.140 ± 0.779	4.121 ± 0.6791	3.860 ± 0.725	3.560 ± 0.975	3.140 ± 1.088
P	0.868	0.013	0.013	0.004	0.023	0.080	0.059

表4 两组术后各时点股四头肌肌力和关节活动度比较($n=40$)

Table 4 Comparison of quadriceps strength and active range of knee flexion between the 2 groups ($n=40$)

组别	股四头肌力			关节活动度/ $^{\circ}$			
	24 h	48 h	72 h	24 h	48 h	72 h	1周
A组	4.300 ± 0.464	4.700 ± 0.464	4.900 ± 0.304	60.180 ± 7.699	71.380 ± 6.762	78.600 ± 7.088	87.950 ± 7.669
B组	4.640 ± 0.486	4.740 ± 0.442	4.920 ± 0.270	60.180 ± 11.980	68.15 ± 10.509	80.620 ± 9.066	86.820 ± 8.793
P	0.278	0.395	0.0476	0.158	0.018	0.318	0.730

3 讨论

TKA后患者尽早开始康复锻炼和下床活动,有利于患者膝关节功能恢复^[15]。然而术后疼痛严重影响其早期功能锻炼,从而影响膝关节功能恢复,同时也增加深静脉血栓及肺栓塞的风险^[16]。因此,良好的术后镇痛至关重要。与静脉镇痛泵自控镇痛或硬膜外镇痛比较,神经阻滞可提供更理想的镇痛效果,同时减少使用阿片类镇痛药物及发生不良反应。

本研究对比连续收肌管阻滞联合坐骨神经阻滞或局部浸润镇痛对患者的静息痛、活动痛、股四头肌肌力以及关节活动度的影响,结果显示两种阻滞方式均能取得较好的镇痛效果。但是,与B组比较,A组在术后当天及术后24 h VAS评分更低,差异有统计学意义,表明连续收肌管联合坐骨神经阻滞术后短期镇痛效果优于连续收肌管阻滞联合局部浸润,尤其是减轻患者运动时的疼痛。两组术后24, 72 h及术后1周膝关节活动度差异无统计学意义,说明收肌管联合坐骨神经阻滞在提供良好的术后镇痛的同时未影响膝关节运动。两组术中及术后均未出现严重的并发症,表明两组实施收肌管或坐骨神经阻滞为安全有效的镇痛方法。A组患者术后恶心呕吐发生例数少于B组,差异有统计意义,表明收肌管联合坐骨神经阻滞能够减少术后恶心呕吐发生率,可能与术中减少阿片类药物用量有关。两组均未出现谵妄、呼吸抑制、神经损伤、局麻药中毒等并发症,无深静脉血栓、肺栓塞等并发症,也可能与病例数较少有关。文献^[17]报道:辅助单次坐骨神经阻滞有助于提高术后镇痛效果。有研究^[18]显示:在股神经阻滞的基础上增加单次坐骨神经阻滞可以显著缓解手术当天的疼痛,减少阿片类药物用量。有学者^[19]认为用局部麻醉药进行关节周围浸润是区域麻醉的一种替代方法。局部浸润可以在没有麻醉医师的情况下实施,其施行简单和明显的安全性使其在骨科手术疼痛控制方面获得普及^[20]。而目前与安慰剂或者其他麻醉方式比较,对于局部浸润麻醉的有效性还没有达成共识^[21]。目前国内外未见有关收肌管联合坐骨神经阻滞用于TKA的相关研究。Terkawi等^[22]对TKA后疼痛管理方式的170项随机对照试验进行Meta分析,评估17种治疗方式,最终得出阻断多个神经优于阻断单个神经、关节周围浸润或硬膜外镇痛。在超声下进行连续收肌管阻滞置管,位置准确,明显提高阻滞效果。前路坐骨神经阻滞对传统入路进行改良,操作过程中无需患者变换体

位,超声联合神经刺激仪进行精准定位,超声定位下直观地看到药物在神经周围扩散。局部浸润则是盲目注射,膝关节各部位注射效果不够确切并与术者操作有关。然而罗哌卡因在感觉、运动分离阻滞方面有一定优势,但罗哌卡因并不能完全选择性地作用于感觉神经,坐骨神经阻滞引起足踝部麻木给患者带来不适感并影响手术当天的踝关节功能锻炼,因此寻找更优的局部麻醉药及更佳的药物浓度是日后研究的方向。此外,本研究样本量较小,还需更大样本量的研究进一步证实。

综上所述,连续收肌管阻滞联合前路坐骨神经阻滞对TKA患者术后镇痛效果显著,术后并发症少,有利于患者早期进行功能锻炼和康复。

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