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高龄患者髋部骨折手术麻醉策略优化

王晓娜[1]，温晶[1]，王春光[2]

(1. 保定市第二医院麻醉科，河北 保定 071051；2. 保定市第一中心医院麻醉科，河北 保定 071000)

[摘　要]　**目的：**观察3种麻醉方案用于高龄患者髋部骨折手术的效果，以优化高龄患者髋部骨折手术的麻醉策略。**方法：**选择行髋部骨折内固定术的患者90例，美国麻醉医师学会(American Society of Anesthesiologists，ASA) II或III级，年龄80~92岁，随机分为3组(n=30)：腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞组(S组)、腰-骶丛神经阻滞组(L组)和腰-硬联合麻醉组(C组)。S组腹股沟韧带上髂筋膜间隙阻滞给予0.375%罗哌卡因40 mL，骶丛神经阻滞给予0.375%罗哌卡因20mL。L组腰丛神经阻滞给予0.375%罗哌卡因40 mL，骶丛神经阻滞给予0.375%罗哌卡因20 mL。C组蛛网膜下腔注射0.5%罗哌卡因2.5 mL行腰-硬联合麻醉。3组术中静脉泵注右美托咪定，负荷剂量为0.5 μg/kg，维持剂量为0.25 μg/(kg·h)。记录患者入室(T0)、摆放体位(T1)、麻醉后3 min (T2)、麻醉后5 min (T3)、麻醉后10 min (T4)、麻醉后30 min (T5)、切皮即刻(T6)、麻醉后60 min (T7)及麻醉后120 min (T8)时的平均动脉压(mean arterial blood pressure，MAP)及心率(heart rate，HR)。记录T0、T1、T6、术后12 h (T9)及术后24 h (T10)的直观类比标度(visual analog scale，VAS)评分。记录麻醉时间、手术时间、出血量、液体输注量、右美托咪定用量、血管活性药物应用及镇痛补救情况。记录局部麻醉药中毒、神经损伤、血管损伤、全脊髓麻醉等不良事件发生情况。**结果：**与C组、L组比较，S组麻醉时间缩短，T1时点MAP、HR、VAS评分降低(P<0.05)；与C组比较，S组、L组液体输注量、麻黄碱应用率降低，右美托咪定用量增加，T9、T10时点VAS评分降低，T2、T3、T4时点MAP升高，T2、T3时点HR下降(P<0.05)。3组手术时间、出血量、阿托品应用率、镇痛补救率、T0、T6时点VAS评分及不良反应发生率差异均无统计学意义(均P>0.05)。**结论：**超声引导下腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞，操作简便易行，能减轻体位摆放导致的疼痛，维持血流动力学稳定，可有效用于高龄患者髋部骨折手术麻醉术后镇痛。

[关键词]　腹股沟韧带上髂筋膜间隙阻滞；骶丛神经阻滞；髋部骨折；高龄

Optimized strategy of anesthesia for elderly patients undergoing surgery of hip fracture

WANG Xiaona[1], WEN Jing[1], WANG Chunguang[2]

(1. Department of Anesthesiology, Second Hospital of Baoding, Baoding Hebei 071051; 2. Department of Anesthesiology, First Center Hospital of Baoding, Baoding Hebei 071000, China)

Abstract　**Objective:** To observe the anesthetic effect of 3 anesthetic schemes for elderly patients undergoing surgery of

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通信作者(Corresponding author)：王晓娜，Email: bdsmzk@163.com
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hip fracture, so as to optimize the strategy of anesthesia. **Methods:** Ninety elderly patients undergoing internal fixation surgery of hip fracture, aged 80–92 years, with American Society of Anesthesiologists (ASA) II or III, were randomly assigned into 3 groups (n=30): a supra-inguinal fascia iliaca compartment block combined with sacral plexus block group (group S), a lumbar plexus combined with sacral plexus block group (group L), and a combined spinal and epidural anesthesia group (group C). In group S, supra-inguinal fascia iliaca compartment block was performed with 0.375% ropivacaine 40 mL, and sacral plexus block was performed with 0.375% ropivacaine 20 mL. In group L, lumbar plexus block was performed with 0.375% ropivacaine 40 mL and sacral plexus block was performed with 0.375% ropivacaine 20 mL. In group C, combined spinal and epidural anesthesia was performed with 0.5% ropivacaine 2.5 mL. Dexmedetomidine was injected during the surgery. The loading dose of dexmedetomidine was 0.5 μg/kg, and the maintenance dose was 0.25 μg/(kg·h). The mean arterial blood pressure (MAP) and heart rate (HR) of the patients were recorded at operation room admission (T0), positioning (T1), 3 min after anesthesia (T2), 5 min after the anesthesia (T3), 10 min after the anesthesia (T4), 30 min after the anesthesia (T5), skin incision (T6), 60 min after the anesthesia (T7), and 120 min after the anesthesia (T8). The visual analogue scale (VAS) were recorded at T0, T1, T6, 12 hours after the surgery (T9), and 24 hours after the surgery (T10). The time of anesthesia, the time of surgery, the amount of bleeding, volume of fluid infusion, consumption of dexmedetomidine, consumption of vasoactive agents, and rescue analgesia were recorded. Adverse events such as local anesthetic poisoning, nerve injury, vascular injury, and total spinal block were recorded. **Results:** Compared with group C and group L, the time of anesthesia, MAP, HR and VAS at T1 were decreased in group S (P<0.05). Compared with group C, volume of fluid infusion, application rate of ephedrine, HRs at T2, T3, and VAS scores at T9, T10 were decreased in group S and group L (P<0.05). Compared with group C, consumption of dexmedetomidine, and MAPs at T2, T3, T4 were increased in group S and group L (P<0.05). There was no statistically significant difference in term of the time of surgery, the amount of bleeding, application rate of atropine, the rate of rescue analgesia, VAS scores at T0, T6, and the incidence of adverse events (P>0.05). **Conclusion:** Ultrasound-guided supra-inguinal fascia iliaca compartment block combined with sacral plexus block is easy to operate. It could alleviate the pain caused by position change, and maintain hemodynamic stability. Therefore, it could be effectively used in anesthesia of hip fracture and postoperative analgesia for elderly patients.

Keywords supra-inguinal fascia iliaca compartment block; sacral plexus block; hip fracture; elderly

随着社会老龄化进程的推进，因病需手术的老年患者日益增多，其中尤以髋部骨折手术居多。研究[1]表明：麻醉方法为髋部骨折术后病死率的独立危险因素，故选择合适的麻醉方法至关重要。目前，老年髋部骨折手术常用的麻醉方式包括全身麻醉、椎管内麻醉与周围神经阻滞麻醉。与椎管内麻醉比较，腰丛联合坐骨神经阻滞用于老年髋部骨折手术麻醉，有利于维持血流动力学稳定，并提供有效的术后镇痛[2-4]。然而，由于腰丛位置较深，穿刺过程较困难，且易造成神经、血管及肾脏损伤，甚至发生全脊髓麻醉等严重并发症。此外，腰丛神经阻滞体位摆放过程中的疼痛刺激可引起患者循环波动，甚至诱发心脑血管意外。最近的研究[5-7]表明：素有“前路腰丛神经阻滞”之称的腹股沟韧带下髂筋膜间隙阻滞联合骶丛神经阻滞可满足全髋关节置换术麻醉需求。最新研究[8-9]发现：与传统的腹股沟韧带下髂筋膜阻滞比较，腹股沟韧带上髂筋膜间隙阻滞局部麻醉药向腰丛神经扩散范围更广。理论上讲，腹股沟韧带上髂筋膜间隙阻滞联合骶丛神经阻滞可满足老年髋部骨折手术的麻醉需求。本研究拟比较腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞、腰丛联合骶丛神经阻滞和腰-硬联合麻醉用于高龄患者髋部骨折手术的麻醉效果，为优化高龄患者髋部骨折手术麻醉策略提供参考。

1 对象与方法

1.1 对象

选择2019年5月至12月择期行髋部骨折内固

定术的患者90例，美国麻醉医师学会(American Society of Anesthesiologists, ASA) II或III级，性别不限，年龄80~92岁，体重52~76 kg。采用随机数字表法，将患者分为3组(n=30)：腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞组(S组)、腰-骶丛神经阻滞组(L组)和腰-硬联合麻醉组(C组)。排除标准：对罗哌卡因、右美托咪定等研究药物过敏，凝血功能障碍，穿刺部位感染及沟通障碍不能配合者。本研究获保定市第二医院医学伦理委员会批准，且患者签署知情同意书。

1.2 麻醉方法

所有患者禁食禁饮，未给予术前用药。入室后开放静脉通路，输注复方林格氏液5 mL/(kg·h)。鼻导管吸氧1~2 L/min，监测心电图(electrocardiogram，ECG)、血氧饱和度(oxygen saturation，SpO_2)和无创血压。局部麻醉下行桡动脉穿刺置管，持续监测有创动脉血压。

S组患者采用超声引导下腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞麻醉。腹股沟韧带上髂筋膜间隙阻滞：患者仰卧位，将高频线阵超声探头纵向放置于患肢髂前上棘的位置，识别髂前上棘和髂肌后将超声探头向肚脐方向旋转，并在超声影像中辨认皮下组织、腹外斜肌、腹内斜肌、腹横肌、腰大肌及髂肌等结构，髂筋膜覆盖于髂肌上。局部麻醉后，采用平面内技术进针，当穿刺针尖到达髂筋膜下时，采用水分离技术确认针尖位置正确后，注射0.4%罗哌卡因40 mL。超声引导下行骶丛神经阻滞：患者健侧卧位，从髂后上棘向坐骨结节做一连线，在此连线上距髂后上棘6 cm处做标记。低频凸阵探头置于标记点附近向坐骨结节方向扫描，骶丛神经位于骶骨与髂骨之间的高回声结构。局部麻醉后，采用平面内技术进针，当穿刺针尖到达骶丛神经附近时，采用水分离技术确认针尖位置正确后，注射0.4%罗哌卡因20 mL。L组患者采用超声引导下腰-骶丛神经阻滞。腰丛神经阻滞：取患肢在上侧卧位，取髂脊最高点连线与脊柱正中线交点，患侧旁开4~5 cm处做标记。低频凸阵探头平行于脊柱正中线置于标记点附近，腰丛神经位于L_3和L_4横突间腹侧1.5~2.0 cm处的椭圆高回声区。局部麻醉后，采用平面外技术进针，当穿刺针尖到达腰丛神经附近时，采用水分离技术确认针尖位置正确后，注射0.4%罗哌卡因40 mL。骶丛神经阻滞方法同S组。C组患者采用腰-硬联合麻醉。取患肢在上侧卧位，选择$L_{3\sim4}$间隙作为穿刺点，蛛网膜下腔注射0.5%等比重罗比卡因2.5 mL，将麻醉平面控制于T10水平。

当麻醉平面低于切口位置时，S组及L组由术者应用1%利多卡因局部浸润进行镇痛补救，C组则通过硬膜外导管追加0.5%罗哌卡因3~5 mL进行镇痛补救。术中静脉泵注右美托咪定镇静，负荷剂量为0.5 μg/kg，维持剂量为0.25 μg/(kg·h)。当平均动脉压(mean arterial blood pressure，MAP)<基础值的80%或<65 mmHg(1 mmHg=0.133 Kpa)时，加快输液并静脉注射麻黄碱5 mg纠正低血压。当心率(heart rate，HR)<50次/min时，静脉注射阿托品0.4 mg。

1.3 观察指标

记录患者入室(T0)、摆放体位(T1)、麻醉后3 min (T2)、麻醉后5 min (T3)、麻醉后10 min (T4)、麻醉后30 min (T5)、切皮即刻(T6)、麻醉后60 min (T7)及麻醉后120 min (T8)患者的MAP及HR。记录T0、T1、T6、术后12 h (T9)及术后24 h (T10)的直观类比标度(visual analog scale，VAS)评分。记录麻醉时间、手术时间、出血量、液体输注量、右美托咪定用量、血管活性药物应用及镇痛补救情况。记录局部麻醉药中毒、神经损伤、血管损伤、全脊髓麻醉等不良事件发生情况。

1.4 统计学处理

采用SPSS 17.0软件进行数据分析。计量资料以均数±标准差($\bar{x}$±s)表示，组间比较采用单因素方差分析；计数资料以例(%)表示，组间比较采用χ^2检验。P<0.05为差异有统计学意义。

2 结果

2.1 一般资料比较

3组一般资料比较差异均无统计学意义(均P>0.05，表1)。

2.2 麻醉、手术相关指标比较

与C组、L组比较，S组麻醉时间缩短(P<0.05)；与C组比较，S组、L组液体输注量、麻黄碱应用率降低，右美托咪定用量增加(P<0.05)；3组手术时间、出血量、阿托品应用率及镇痛补救率差异均无统计学意义(均P>0.05，表2)。

2.3 不同时间点 MAP 及 HR 比较

与L组、C组比较，S组T1时点MAP、HR下降(P<0.05)；与C组比较，S组、L组T2、T3、T4时

点MAP升高(P<0.05)；与C组比较，S组、L组T2、T3时点HR下降(P<0.05，表3)。

2.4 各时点 VAS 评分比较

与C组、L组比较，S组T1时点VAS评分降低(P<0.05)；与C组比较，S组、L组T9、T10时点VAS评分降低(P<0.05)；3组患者T0、T6时点VAS评分差异均无统计学意义(均P>0.05，表4)。

2.5 不良反应发生情况

3组患者均未见局部麻醉药中毒、神经损伤、血管损伤、全脊髓麻醉等不良事件发生。

表1 3组患者一般资料比较(n=30)

Table 1 Comparison of general parameters among the 3 groups (n=30)

组别	年龄/岁	性别(男/女)/例	ASA分级(II/III)/例	体重/kg	手术类型(DHS/PFNA)/例
S组	85.6 ± 5.2	14/16	19/11	62.3 ± 4.8	5/25
L组	86.4 ± 6.8	15/15	18/12	60.4 ± 3.9	7/23
C组	84.2 ± 6.1	15/15	17/13	61.7 ± 3.3	6/24

PFNA：股骨近端防旋髓内钉；DHS：动力髋螺钉。

PFNA: Proximal femoral nail anti-rotation; DHS: Dynamic hip screw.

表2 3组患者麻醉、手术相关指标比较(n=30)

Table 2 Comparison of anesthesia and operation related indexes among the 3 groups (n=30)

组别	麻醉时间/min	手术时间/min	出血量/mL	液体输注量/mL	右美托咪定用量/μg	麻黄碱应用/[例(%)]	阿托品应用/[例(%)]	镇痛补救/[例(%)]
S组	8.6 ± 1.0*#	71.4 ± 3.8	106.4 ± 16.7	986.4 ± 102.7*	48.3 ± 3.5*	0 (0)*	1 (3)	2 (7)
L组	14.1 ± 2.3	74.2 ± 3.6	104.3 ± 15.6	993.6 ± 100.8*	49.1 ± 3.1*	1 (3)*	2 (7)	2 (7)
C组	12.8 ± 1.6	72.8 ± 3.1	102.3 ± 12.4	1 213.6 ± 108.2	35.2 ± 2.5	11 (37)	1 (3)	0 (0)

与C组比较，*P<0.05；与L组比较，#P<0.05。

Compare with group C, *P<0.05; compare with group L, #P<0.05.

表3 3组患者MAP及HR比较(n=30)

Table 3 Comparison of MAP and HR among the 3 groups (n=30)

时间点	MAP/mmHg			HR/(beats·min^{-1})		
	S组	L组	C组	S组	L组	C组
T0	95.3 ± 5.3	94.6 ± 8.2	96.2 ± 6.5	75.6 ± 3.2	73.5 ± 4.7	72.8 ± 3.8
T1	96.6 ± 3.2*#	116.8 ± 5.4	119.8 ± 8.6	74.2 ± 2.8*#	96.5 ± 10.1	98.7 ± 9.4
T2	94.3 ± 5.7*	95.3 ± 6.2*	78.3 ± 5.2	75.1 ± 4.2*	78.4 ± 3.8*	88.4 ± 3.8
T3	96.2 ± 3.1*	95.7 ± 4.5*	77.3 ± 4.1	74.5 ± 3.6*	78.7 ± 5.4*	87.8 ± 6.6
T4	92.3 ± 4.2*	91.8 ± 4.6*	80.6 ± 3.3	72.6 ± 5.1	73.7 ± 5.8	76.0 ± 4.6
T5	83.5 ± 6.2	85.6 ± 7.8	85.6 ± 7.8	65.5 ± 5.3	64.2 ± 8.4	64.8 ± 5.1
T6	83.3 ± 3.8	84.5 ± 5.1	82.9 ± 4.7	64.6 ± 6.3	66.4 ± 6.2	63.8 ± 5.6
T7	86.6 ± 2.1	84.6 ± 3.2	83.6 ± 4.5	67.3 ± 8.4	66.5 ± 3.9	68.4 ± 5.3
T8	85.7 ± 3.9	86.2 ± 4.3	85.6 ± 3.3	69.7 ± 5.2	71.3 ± 5.5	70.6 ± 6.2

与C组比较，*P<0.05；与L组比较，#P<0.05。

Compared with group C, *P<0.05; compared with group L, #P<0.05.

表4 3组患者VAS评分比较(n=30)

Table 4 Comparison of VAS score among the 3 groups (n=30)

组别	VAS 评分				
	T0	T1	T6	T9	T10
S组	4.2 ± 0.8	2.7 ± 0.4*#	1.4 ± 0.2	1.8 ± 0.5*	2.2 ± 0.3*
L组	4.1 ± 0.6	6.2 ± 1.2	1.5 ± 0.3	2.0 ± 0.4*	2.4 ± 0.4*
C组	4.3 ± 0.5	6.4 ± 1.3	1.0 ± 0.1	4.2 ± 0.8	3.5 ± 0.7

与C组比较, *P<0.05；与L组比较, #P<0.05。

Compare with group C, *P<0.05; compare with L, #P<0.05.

3 讨论

老年患者外伤性疾病中最常见的是髋部骨折。早期手术治疗可减少坠积性肺炎、压疮等并发症的发生，改善患者预后。此类患者多合并心、脑血管疾病等多种全身性疾病，麻醉风险极高。目前，老年髋部骨折麻醉方式多为椎管内麻醉或外周神经阻滞[2-4,9-12]。本研究发现：S组麻醉操作时间短于L组、C组。分析原因为：1)老年患者椎体退行性变及棘上、棘间韧带钙化等病理改变导致椎管内麻醉操作困难；2)腰丛神经位置较深，穿刺过程中易受到毗邻器官如肾脏及骨性组织干扰；3)腹股沟韧带上髂筋膜间隙较腰丛神经位置表浅，在超声下容易辨认；进针路径短，且无骨性组织或其他脏器干扰。

老年患者椎管间隙变窄，且中枢神经系统对局部麻醉药敏感性增强，易导致麻醉平面过高，出现血流动力学剧烈波动，从而诱发心脑血管意外。研究表明：与椎管内麻醉比较，腰丛联合坐骨神经阻滞用于老年髋部骨折手术麻醉，可维持血流动力学稳定，并提供有效的术后镇痛[2]。本研究发现：L组、S组患者麻醉后MAP、HR较C组平稳，且L组、S组患者术中麻黄碱应用率及液体输注量较C组明显减少，提示周围神经阻滞较椎管内麻醉对老年患者血流动力学影响轻微，与先前研究[2]结果吻合。椎管内麻醉及腰丛神经阻滞体位摆放过程中的疼痛刺激强烈，可引起患者循环剧烈波动，甚至诱发心脑血管意外。髂筋膜间隙阻滞无需特殊体位，可有效抑制体位摆放过程中因骨折端错位而产生的疼痛[13]。本研究发现：S组体位摆放时VAS评分、MAP及HR明显低于L组、C组，提示腹股沟韧带上髂筋膜间隙阻滞可有效抑制体位摆放过程中产生的疼痛，增加患者的舒适性。

髋关节的感觉主要受括股神经、闭孔神经、坐骨神经、臀上神经支配[14-15]。髋部手术皮肤切口的感觉主要受股外侧皮神经、肋下神经皮支、髂腹下神经外侧皮支及臀上皮神经支配[14-15]。研究[8,16-17]表明：超声引导下腹股沟韧带上髂筋膜间隙阻滞可同时阻滞股神经、股外侧皮神经、闭孔神经、髂腹下神经及肋下神经。骶旁入路坐骨神经阻滞因可阻滞坐骨神经、臀上神经及其皮神经分支，故为髋部骨折手术的首选阻滞入路。本研究结果显示3种麻醉方式均顺利完成手术，提示腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞可满足髋部骨折手术的麻醉需要。尽管L组、S组均有2例患者出现阻滞不全，但仅需术者采用切口处局部浸润即可取得满意的麻醉效果。原因可能与神经解剖变异或骨折部位肿胀致术者解剖定位不准确从而使切口超过神经阻滞的范围有关。

《中国老年髋部骨折患者麻醉及围术期管理指导意见》[18]建议：实施区域阻滞时，可持续输注低剂量右美托咪定[0.1~0.3 μg/(kg·h)]辅助镇静。鉴于周围神经阻滞为单侧肢体麻醉，术中强迫体位会产生不适感，故本研究术中联合低剂量右美托咪定静脉泵注，在保留自主呼吸的同时，产生适度的镇静、镇痛效应。本研究发现：S组、L组右美托咪定用量较C组增加，提示与椎管内麻醉比较，周围神经阻滞需较深的镇静才能抑制强迫体位产生的不适。心动过缓是右美托咪定常见的不良反应。本研究中未见心动过缓的发生，可能与使用剂量较少有关。

本研究存在一定的局限性：1)局部麻醉药用量较大，虽未发现局部麻醉药中毒病例，但适宜的局部麻醉药浓度仍有待探讨；2)对象仅限于老年髋部骨折闭合复位内固定手术患者，腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞是否适用于髋关节置换术患者的麻醉仍有待研究。

综上所述，超声引导下腹股沟韧带上髂筋膜间隙联合骶丛神经阻滞，操作简便易行，能减轻体位摆放导致的疼痛，维持血流动力学稳定，可有效用于高龄患者髋部骨折手术麻醉，并提供术后镇痛效果。

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