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Effectiveness of ultrasound guided pectoral nerve block combined with no background patient controlled intravenous analgesia in postoperative pain control of partial mastectomy patients

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Abstract: **Objective** To study the effectiveness and safety of ultrasound guided pectoral nerve block combined with no background patient controlled intravenous analgesia in postoperative pain control of partial mastectomy patients. **Methods** A total of 60 patients who underwent elective partial mastectomy at Pukou Traditional Chinese Medicine Hospital Affiliated to China Pharmaceutical University from May 2022 to May 2023 were selected and divided into ultrasound guided pectoral nerve block group (M group, n=30) and control group (N group, n=30). Both groups received no background patient controlled intravenous analgesia. Patients in M group received 0.2% ropivacaine 30 mL for pectoral nerve block, while patients in group N did not receive any other treatment. The outcome measures were VAS scores during static and coughing at the time point of patient leaving resuscitation room (T_0), 4 hours (T_1), 12 hours (T_2), 24 hours (T_3), and 48 hours (T_4) after surgery, as well as the total analgesia consumption and rescue analgesia dosage. **Results** Patients in group M showed a lower rest VAS at T_0, T_1, T_2, and T_3 time point (P<0.05), and lower cough VAS at T_0, T_1, and T_2 time point (P<0.05) than patients in group N. In group M, the total intravenous analgesia consumption and number of presses were significantly less than group N at 48 hours after surgery (P<0.05). There was no statistically significant difference in the incidence of postoperative adverse reactions between the two groups (P>0.05), and there were no complications related to nerve block in group M. **Conclusion** Ultrasound guided pectoral nerve block combined with no background patient controlled intravenous analgesia was able to provide potent postoperative pain control, reduce analgesia consumption in partial mastectomy patients.

Keywords: Ultrasound guided pectoral nerve block; Postoperative pain control; Partial mastectomy; No background patient controlled intravenous analgesia

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Breast surgeries, especially radical mastectomy for breast cancer and segmental resection of the breast, often result in moderate to severe postoperative pain, affecting patients' quality of life and recovery significantly [1]. Therefore, optimizing postoperative pain management for these patients has become an urgent clinical issue. Multimodal analgesia is postoperative pain management widely used currently, which refers to the combination of different analgesic techniques and medications to enhance pain relief and reduce adverse effects [2]. According to the concept of multimodal analgesia, various analgesic strategies have emerged in recent years, such as patient-controlled intravenous analgesia (PCIA) combined with nerve block analgesia, and background-free PCIA [3-5]. Ultrasound-guided nerve blocks have gained increasing recommendation in guidelines and consensus due to their precise localization, effective pain relief, and minimal adverse effects, playing a significant role in multimodal analgesia [6]. Breast surgeries, such as partial mastectomy, involve a large trauma area and intricate sensory nerves, making it difficult to achieve effective pain relief with single nerve blocks. In 2012, Blanco *et al.* [7] reported on the modified pectoral nerve block type II (PECS II), which blocks the lateral cutaneous branches of the intercostal nerves, the thoracodorsal nerve, and the long thoracic nerve. Although PECS II provides extensive nerve blockade, it still may not cover the entire surgical area, and the duration of local anesthetic effect is limited. Therefore, providing comprehensive postoperative pain relief for breast cancer patients while minimizing related side effects remains a critical clinical challenge. Background-free PCIA allows for pain relief according to patient demand, with controlled duration of action and minimal side effects. However, there is currently no literature on the combined use of pectoral nerve blocks with background-free PCIA. This study aims to explore

the safety and effectiveness of this analgesic regimen.

1 Materials and Methods

1.1 General Information

This study was approved by the Ethics Committee of Pukou Traditional Chinese Medicine Hospital Affiliated to China Pharmaceutical University (20230018). Patients undergoing partial mastectomy at Pukou Traditional Chinese Medicine Hospital Affiliated to China Pharmaceutical University from May 2022 to May 2023 were selected, and they signed informed consent forms before surgery.

Inclusion criteria: Females, aged 18-60 years, ASA I-III, normal intellectual function, able to communicate normally.

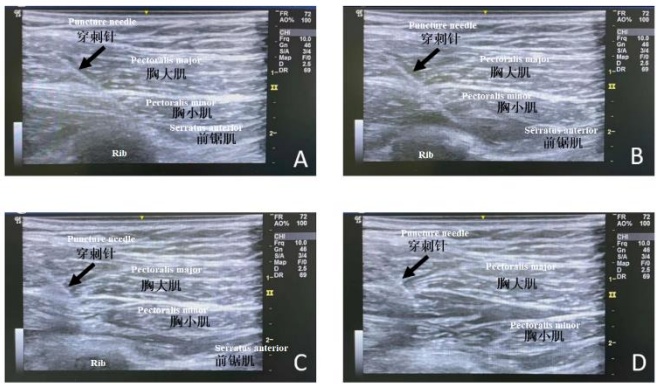
Exclusion criteria: (1) Severe infection at the puncture site; (2) known allergy to amide-type local anesthetics; (3) known chest deformity; (4) diagnosed as thoracodorsal nerve entrapment, pain sensitization or chronic pain; (5) drug abuse; (6) with severe cardiovascular or cerebrovascular disease, coagulation disorders, hepatic or renal dysfunction; (7) already participating in other drug or clinical trials.

Exclusion criterion: Hospital stay less than 3 days postoperatively, withdrawal during the trial process.

A total of 60 patients were included in this study and were evenly divided into two groups by digital randomization table method: the pectoral nerve block combined with background-free PCIA group (Group M, n=30) and the background-free PCIA group (Group N, n=30).

1.2 Methods

On the day of surgery, patients underwent routine monitoring in the operating room, including heart rate (HR), respiratory rate (RR), peripheral oxygen saturation (SpO_2), end-tidal carbon dioxide ($P_{ET}CO_2$), invasive arterial blood pressure, temperature, and bispectral index (BIS) monitoring. General anesthesia induction was performed via intravenous induction with midazolam 0.05 mg/kg, propofol 1.5 mg/kg, sufentanil 0.4 ug/kg, and vecuronium bromide 0.1 mg/kg. Post-intubation maintenance included dexmedetomidine, propofol, remifentanil, sevoflurane, etc., to maintain the BIS value between 40 and 60. Both groups received postoperative PCIA with a formulation of sufentanil 2 ug/kg, tramadol 4 mg/kg, and tropisetron hydrochloride 0.1 mg/kg diluted in saline to 100 mL, with background-free infusion and a Bolus of 5 mL with a lockout time of 30 minutes. If VAS≥6, rescue analgesia was provided with intravenous parecoxib sodium 40 mg. Group M received pectoral nerve block with PECS II immediately after surgery under ultrasound guidance. The specific procedure involved placing the ultrasound probe at the midclavicular line at the level of the outer 1/3 of the clavicle, identifying the axillary artery and vein, moving the probe towards the axilla, identifying the edge of the pectoralis minor muscle, injecting 20 mL of 0.2% ropivacaine hydrochloride between the pectoralis minor and its deep surface ribs or between the anterior serratus muscle at the levels of the third and fourth ribs **(Figure 1)**. All patients had the endotracheal tube removed after surgery and were observed for 20 minutes, with modified Aldrete score≥9 before being sent back to the ward.



Note: A, the pectoralis major, pectoralis minor, serratus anterior, and ribs were explored, and the puncture needle was placed between the pectoralis minor and serratus anterior; B, 20 mL of 0.2% ropivacaine hydrochloride was injected between the pectoralis minor and serratus anterior; C, the puncture needle was placed between the pectoralis major and pectoralis minor muscles; D, 10 mL of 0.2% ropivacaine hydrochloride was injected between the pectoralis major and pectoralis minor.

Fig. 1 Schematic diagram of PECS II nerve block

1.3 Observation Indicators

Vital signs at the time of leaving the operating room (T_0), 4 hours post-operation (T_1), 12 hours post-operation (T_2), 24 hours post-operation (T_3), and 48 hours post-operation (T4), were recorded, including VAS pain scores (at rest and during coughing). Dosage of postoperative analgesic drug, incidents requiring rescue analgesia, and complications related with anesthesia and nerve block were statistic analyzed.

1.4 Statistical Analysis

Data were statistically analyzed using SPSS. Normally distributed continuous data were presented as $\overline{X} \pm s$, and independent t-tests was used in the between-group comparisons, while repeated measures ANOVA and pairwise LSD-t test were used in the comparisons at different time points. Non-normally distributed continuous data were presented as M (P_{25}, P_{75}), and Mann-Whitney U test was conducted for group comparisons. Count data were presented as frequencies (percentages), and chi-square tests or Fisher's exact test was conducted in the between-group comparison. P<0.05 meant the difference was significant.

2 Results

2.1 Baseline Data Comparison

A total of 60 patients were enrolled in the study. There was no statistically significant difference in baseline characteristics such as age, height, and BMI between the two groups (P>0.05) **[Table 1]**.

Tab.1 Comparison of general data between two groups (n=30, $\bar{x}$±s)

Group	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m^2)
M group	35.7±7.42	164.1±5.06	64.0±6.78	23.8±2.87
N group	34.7±6.31	165.1±7.18	65.4±7.57	24.2±3.93
t value	0.600	0.624	0.791	0.431
P value	0.551	0.535	0.432	0.668

2.2 VAS Scores

At rest, patients in group M had significantly lower VAS scores at T_0, T_1, T_2, and T_3 compared to those in group N (P<0.05). During coughing at T_0, T_1, and T_2, patients in group M also had significantly lower VAS scores than those in group N (P<0.05) **[Table 2]**.

Tab.2 Comparison of VAS at different time between two groups (n=30, $\bar{x}$±s)

Group	Sate	T_0	T_1	T_2	T_3	T_4
M group	Resting	1.57±1.07[a]	1.17±1.23[a]	2.03±1.13[a]	2.03±1.22[a]	1.37±0.89
N group	Resting	2.83±1.18	2.53±1.38	2.63±1.10	2.63±1.10	1.47±0.93
M group	Coughing	1.83±1.05[a]	1.87±1.14[a]	2.53±1.07[a]	2.33±1.27	1.50±1.01
N group	Coughing	3.13±1.04	2.93±1.29	3.13±1.17	2.53±1.55	1.97±1.00

Note: Compared with N group, [a]P<0.05.

2.3 Comparison of SBP and HR

At T_0 and T_1, patients in group M had significantly lower SBP than those in group N (P<0.05), and there was no significant difference between two groups at other time-points (P>0.05) **[Table 3]**.

Tab.3 Comparison of SBP and HR at different time between two groups (n=30, $\bar{x}$±s)

Group		T_0	T_1	T_2	T_3	T_4
M group	SBP	128.9±10.94[a]	126.4±13.68[a]	132.2±15.78	133.8±13.46	138.1±12.33
N group	SBP	137.3±8.97	135.8±13.16	139.2±11.78	140.5±13.74	140.1±12.83
M group	HR	76.7±10.78	76.9±9.50	77.6±9.75	75.9±10.34	73.7±10.37
N group	HR	75.1±11.28	74.6±10.09	75.0±10.33	74.4±12.14	73.1±11.80

Note: Compared with N group, [a]P<0.05.

2.4 Postoperative Analgesic Use Statistics

Patients in group M had significantly fewer PCIA press times and lower cumulated dosage than those in group N (P<0.05) **[Table 4]**.

2.6 Statistical Analysis of Postoperative Adverse Reactions

There was no statistically significant difference between the two groups in the incidence rates of nausea, vomiting, itching, dizziness, drowsiness, or respiratory depression (P>0.05) **[Table 5]**. No nerve block-related complications such as pneumothorax or hematoma were observed in group M.

Tab.4 Comparison of analgesia consumption between two groups (n=30)

Group	PCIA press times [M (P_{25}, P_{75})]	Cumulated dosage (mL, $\bar{x}$±s)	Cases of remedial analgesia [Case (%)]
M group	8(6,11)	40.3±15.02	3(10.0)
N group	19(15,22)	90.8±23.53	8(26.67)
$Z/t/\chi^2$ value	5.013	9.908	2.783
P value	<0.001	<0.001	0.095

Tab.5 Comparison of complications between two groups after surgery [n=30,case(%)]

Group	Nausea	Vomiting	Itching	Dizziness	Drowsiness
M group	2(6.67)	0	0	1(3.33)	0
N group	5(16.67)	3(10.00)	2(6.67)	3(10.00)	1(3.33)
χ^2 value	0.647	1.404	0.517	0.268	-
P value	0.421	0.236	0.472	0.605	1.000

Note: a was Fisher's precision probability test.

3 Discussion

Blanco *et al.* [7] have proposed the concept of chest wall nerve blocks for breast surgery patients, thus proposed PECSII block. PECS I block involves injecting local anesthetic between the pectoralis major and minor fascial planes, blocking the medial and lateral pectoral nerves, providing analgesia to the anterolateral chest wall. PECS II block extends PECS I block by additionally injecting local anesthetic between the pectoralis minor and serratus anterior muscles, covering a wider range including the lateral cutaneous branches of the intercostal nerves, the long thoracic nerve, and the thoracodorsal nerve, providing sensory blockade over the second to ninth thoracic vertebra dermatomes [8]. This study employed PECSII block.

Both groups of patients in this study had postoperative VAS <4, indicating effective postoperative analgesia with both methods. Patients in group M had lower VAS scores during coughing at T_0, T_1, T_2, and T_3 compared to those in group N. Patients in group M also used significantly less intravenous analgesics and required fewer instances of rescue analgesia, with no nerve block-related complications such as pneumothorax or puncture site hematoma observed. These results suggest that chest wall nerve blocks can effectively enhance the analgesic effects of PCIA without background infusion and reduce the total amount of intravenous analgesics used. The combined use of chest wall nerve blocks and PCIA without background infusion provides safe and effective pain control for patients undergoing partial mastectomy.

Guided by multimodal analgesia principles, the synergistic effect of systemic and local analgesia reduces adverse drug reactions [9]. For surgeries like partial mastectomy, approximately 30% of patients experience moderate to severe pain within 24 hours postoperatively [10]. Postoperative nerve blocks temporarily reduce or alleviate pain by blocking the transmission of surgical area nociceptive impulses

around nerves, with effective and precise results. PECS II block effectively blocks the medial and lateral nerves of the chest wall (the range of blockade includes the same side chest wall from second to ninth thoracic vertebra), covering the surgical area of partial mastectomy. Scholars have reported that serratus anterior plane blocks can also be used for postoperative analgesia in breast surgery [11]. Serratus anterior plane blocks mainly block the lateral cutaneous branches of the intercostal nerves, providing analgesia mainly to the anterior lateral and some posterior chest areas [12]. For breast surgeries, serratus anterior plane blocks only provide sensory blockade for the lower outer quadrant and part of the upper outer quadrant, making it difficult to cover the upper and lower inner quadrants [13]. Due to the short half-life of commonly used local anesthetics (less than 24 hours), single nerve blocks often require combined use with oral or intravenous analgesics to maintain prolonged analgesic effects.

The traditional delivery strategy of PCIA involves continuous low-background dose infusion combined with small doses on-demand by patients, resulting in excessive background dosing and inadequate on-demand analgesia. To address this issue, the concept of PCIA background-free infusion has emerged. PCIA background-free infusion refers to not setting a background dose while appropriately increasing the medication dose when self-administered by patients, allowing patients to adjust the dose according to their individual feelings, thereby reducing the total amount of drugs and the incidence of adverse reactions [14]. In this study, both groups of patients had a relatively low incidence of postoperative adverse reactions. Although the incidence rate in group M was slightly lower than in group N, the difference between the two groups was not statistically significant. This may be primarily because the group N used PCIA background-free infusion, reducing the total dose of analgesic drugs and subsequently lowering the incidence of adverse reactions.

This study has certain limitations: (1) The enrolled patients were all undergoing partial mastectomy, with smaller pain trauma compared to surgeries like radical mastectomy for breast cancer. Future studies should focus on patients undergoing breast cancer surgery to validate the effectiveness of this analgesic regimen; (2) The follow-up time was short, and the effect of PECS II block on long-term postoperative discomfort is unclear.

In conclusion, ultrasound-guided chest wall nerve blocks combined with PCIA background-free infusion provide effective postoperative analgesia with no significant complications for patients undergoing partial mastectomy.

Conflict of Interest None

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·论　著·

超声引导下胸部神经阻滞联合无背景剂量患者自控静脉镇痛对乳腺部分切除患者术后镇痛的疗效

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摘要：目的　观察超声引导下胸部神经阻滞联合无背景剂量患者自控静脉镇痛（PCIA）用于乳腺部分切除患者术后镇痛的有效性和安全性。**方法**　选择中国药科大学附属浦口中医院 2022 年 5 月至 2023 年 5 月择期行乳腺部分切除的 60 例患者，随机分为 M 组和 N 组，各 30 例。患者术后均行无背景剂量 PCIA，M 组于术毕在超声引导下用 0.2%罗哌卡因 30 mL 行胸壁神经阻滞术，N 组不做其他处理。结局指标为离开复苏室时（T_0）、术后 4 h（T_1）、术后 12 h（T_2）、术后 24 h（T_3）、术后 48 h（T_4）静态及咳嗽时 VAS 评分，静脉镇痛用药总量及补救镇痛次数等。**结果**　T_0、T_1、T_2 及 T_3 时点 M 组患者静态 VAS 评分显著低于 N 组（P<0.05），T_0、T_1 和 T_2 时点 M 组患者咳嗽时 VAS 评分显著低于 N 组（P<0.05）。M 组患者术后 48 h PCIA 按压次数、累计药物使用量显著低于 N 组（P<0.05）。两组患者术后不良反应发生率差异无统计学意义（P>0.05），M 组未发生与神经阻滞相关的并发症。**结论**　超声引导下胸部神经阻滞联合无背景剂量 PCIA 能够有效减低乳腺部分切除患者术后疼痛，减少静脉镇痛药物用量。

关键词：超声引导；胸部神经阻滞；术后镇痛；乳腺部分切除术；无背景剂量；患者自控静脉镇痛
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Effectiveness of ultrasound-guided pectoral nerve block combined with no background patient controlled intravenous analgesia in postoperative pain control of partial mastectomy patients

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Abstract: Objective　To study the effectiveness and safety of ultrasound-guided pectoral nerve block combined with no background patient controlled intravenous analgesia (PCIA) in postoperative pain control of partial mastectomy patients. **Methods**　A total of 60 patients who underwent elective partial mastectomy at Pukou Traditional Chinese Medicine Hospital Affiliated to China Pharmaceutical University from May 2022 to May 2023 were selected and divided into group M and group N, with 30 cases in each growp. Both groups received no background PCIA. Patients in M group received 0.2% ropivacaine 30 mL for pectoral nerve block, while patients in group N did not receive any other treatment. The outcome measures were VAS scores during static and coughing at the time point of patient leaving resuscitation room (T_0), 4 hours (T_1), 12 hours (T_2), 24 hours (T_3), and 48 hours (T_4) after surgery, as well as the total analgesia consumption and rescue analgesia dosage. **Results**　Patients in group M showed a lower rest VAS at T_0, T_1, T_2, and T_3 time point (P<0.05), and lower cough VAS at T_0, T_1, and T_2 time point than patients in group N (P<0.05). In group M, the total intravenous analgesia consumption and number of presses were significantly less than group N at 48 hours

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after surgery ($P<0.05$). There was no statistically significant difference in the incidence of postoperative adverse reactions between the two groups ($P>0.05$), and there was no complication related to nerve block in group M. **Conclusion** Ultrasound-guided pectoral nerve block combined with no background PCIA is able to provide potent postoperative pain control, reduce analgesia consumption in partial mastectomy patients.

Keywords: Ultrasound-guided; Pectoral nerve block; Postoperative analgesia; Partial mastectomy; No background; Patient controlled intravenous analgesia

Fund program: Jiangsu Medical Association Anesthesiology Research Special Fund Project [SYH-32021-0042 (2021037)]

乳腺手术,尤其是乳腺癌根治术,乳腺区段切除术等,常伴随中到重度的术后疼痛,严重影响患者的生活质量及术后康复[1]。多模式镇痛是目前广泛采用的术后镇痛模式,是指联合使用不同镇痛方式、镇痛药物以达到增强镇痛效果、减少镇痛药物不良反应的效果[2]。在多模式术后镇痛理念的指导下,近年来涌现出多种镇痛方案,如患者自控静脉镇痛(PCIA)联合神经阻滞镇痛,无背景剂量 PCIA 等新技术[3-5]。超声引导下神经阻滞具有镇痛效果确切、定位精准和不良反应少等特点,在多模式镇痛中发挥重要作用[6]。乳腺部分切除等乳腺手术创伤范围较大,涉及感觉神经繁杂,单一神经的阻滞难以取得良好的镇痛效果。2012 年,Blanco 等[7]报道了改良胸部神经阻滞(pectoral nerve block Ⅱ, PECSⅡ),能够阻滞肋间神经外侧皮支、胸长神经和胸背神经等。虽然 PECSⅡ 阻滞范围较大,但仍难以覆盖全部手术范围,且局麻药物作用时间有限。无背景剂量的 PCIA 能够按患者需求提供镇痛,作用时长可控且副作用少,但目前尚未见应用 PECSⅡ联合无背景剂量 PCIA 的相关报道,本研究拟对该镇痛方案的安全性和有效性进行探索。

1　资料与方法

1.1　一般资料　本研究经过中国药科大学附属浦口中医院伦理委员会审批(20230018)。选取 2022 年 5 月至 2023 年 5 月间在中国药科大学附属浦口中医院行乳腺部分切除的患者,于术前签署参与研究的知情同意书。(1) 入组标准:年龄 18~60 岁,女性,ASA Ⅰ~Ⅲ级,智力水平正常,能正常交流;(2) 排除标准:穿刺部位有严重感染;已知对酰胺类局麻药过敏;有胸部畸形;已确诊有胸长神经卡压症、疼痛敏化、慢性疼痛患者;滥用药物或毒品;患有严重心脑血管疾病;凝血功能障碍、肝肾功能障碍者;已参与其他药物或临床试验的患者。(3) 剔除标准:术后住院时间不足 3 d,试验过程中退出。

本研究共纳入患者 60 例,采用数字随机表法将患者平均分为两组,PECSⅡ联合无背景剂量 PCIA 组(M 组)30 例与无背景剂量 PCIA 组(N 组)30 例。两组患者年龄、身高、BMI 等基线数据差异无统计学意义($P>0.05$)。见表 1。

表 1　两组一般情况比较　($n=30$, $\bar{x}\pm s$)

Tab. 1　Comparison of general data between two groups　($n=30$, $\bar{x}\pm s$)

组别	年龄(岁)	身高(cm)	体重(kg)	BMI(kg/m^2)
M 组	35.72±7.44	164.12±12.88	63.97±28.03	24.59±9.01
N 组	34.67±6.73	165.12±11.88	65.42±22.58	24.88±5.87
t 值	0.573	0.313	0.221	0.148
P 值	0.569	0.756	0.826	0.883

1.2　方法　手术当日,两组患者进入手术室后行常规监测,包括心率、呼吸、脉搏氧饱和度(SpO_2)、呼末二氧化碳($P_{ET}CO_2$)、有创动脉血压、体温、脑电双频指数(BIS)等。全麻诱导采用静脉诱导方式,咪达唑仑 0.05 mg/kg、丙泊酚 1.5 mg/kg、舒芬太尼 0.4 μg/kg、维库溴铵 0.1 mg/kg,插管后应用右美托咪定、丙泊酚、瑞芬太尼、七氟烷等维持,保持 BIS 值处于 40~60。两组患者术毕接 PCIA,配方为舒芬太尼 2 μg/kg+曲马多 4 mg/kg+盐酸托烷司琼 0.1 mg/kg 加入生理盐水配制到100 mL,无背景剂量,Bolus 量 5 mL,锁定时间 30 min;若 VAS 疼痛评分≥6 分,注射帕瑞昔布钠 40 mg 静脉注射进行补救镇痛。M 组术毕在超声引导下行 PECSⅡ型阻滞,具体操作过程为超声探头置于锁骨中外 1/3 水平,识别腋动静脉后向远段腋窝方向移动探头探及胸小肌边缘,在第 3 和第 4 肋水平,注射 0.2%盐酸罗哌卡因20 mL于胸小肌和其深面的肋骨或前锯肌之间,注射 10 mL 于胸大肌和胸小肌之间(图 1)。所有患者术毕拔除气管导管后观察 20 min,改良 Altrete 评分≥9 分,送回病房。

1.3　观察指标　记录离开手术室时(T_0)、术后 4 h(T_1)、术后 12 h(T_2)、术后 24 h(T_3)、术后 48 h(T_4)时的生命体征和 VAS 疼痛评分(平静、咳嗽),统计术后 48 h 镇痛药物使用量、使用补救镇痛药物的例次,麻醉以及神经阻滞相关并发症等。

1.4　统计学方法　采用 SPSS 对数据进行统计分析。正态分布的计量资料采用 $\bar{x}\pm s$ 表示,组间比较采用独

立样本 t 检验，不同时间点数据的比较采用重复测量资料的方差分析及两两比较的 LSD-t 检验；非正态分布的计量资料以 $M(P_{25}, P_{75})$ 表示，组间比较采用 Mann-Whitney U 检验；计数资料采用例(%)表示，组间比较采用 χ^2 检验或 Fisher 确切概率法。P<0.05 为差异有统计学意义。

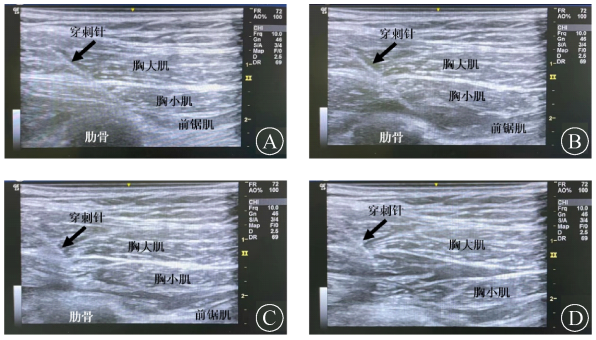
2　结　果

2.1　VAS 疼痛评分　在静息状态下，T_0、T_1、T_2 及 T_3 时点，M 组患者静息 VAS 评分显著低于 N 组（P<0.05）。在 T_0、T_1 及 T_2 时点，M 组患者咳嗽时 VAS 评分显著低于 N 组患者（P<0.05）。见表 2。

2.2　收缩压(SBP)和心率比较　M 组患者在 T_0 和 T_1 时点的 SBP 低于 N 组（P<0.05），其他时间点两组比较差异无统计学意义（P>0.05）。见表 3。

2.3　术后镇痛用药统计　M 组患者的 PCIA 按压次数和累计药物使用量均少于 N 组，差异有统计学意义（P<0.05）。两组患者使用补救镇痛患者的比例差异无统计学意义（P>0.05）。见表 4。

2.4　患者术后不良反应统计　两组患者不良反应发生率差异无统计学意义（P>0.05）。见表 5。M 组患者未发现气胸、血肿、局麻药中毒等神经阻滞相关并发症。



注：A，探及胸大肌、胸小肌、前锯肌和肋骨，穿刺针置于胸小肌和前锯肌之间；B，在胸小肌和前锯肌之间注射 20 mL 0.2%盐酸罗哌卡因注射液；C，穿刺针置于胸大肌和胸小肌之间；D，在胸大肌和胸小肌之间注射 10 mL 0.2%盐酸罗哌卡因注射液。

图 1　PECS Ⅱ神经阻滞示意图
Fig. 1　Schematic diagram of PECS Ⅱ nerve block

表 2　两组患者不同时间点 VAS 评分比较　（n=30，分，$\bar{x}\pm s$）
Tab. 2　Comparison of VAS scores at different time between two groups　（n=30, point, $\bar{x}\pm s$）

组别	状态	T_0	T_1	T_2	T_3	T_4
M 组	静息	1.55±0.55[a]	1.17±0.34[a]	2.03±0.17[a]	2.03±0.73[a]	1.35±0.48
N 组	静息	2.88±0.79	2.55±0.64	2.63±0.29	2.23±1.89	1.45±0.50
M 组	咳嗽	1.86±0.35[a]	1.87±0.60[a]	2.53±0.17[a]	2.33±0.66	1.55±0.31
N 组	咳嗽	3.05±0.79	2.95±0.87	2.92±1.03	2.53±1.19	1.97±0.55

注：与 N 组比较，[a]P<0.05。

表 3　两组患者不同时间点 SBP 和心率比较　（n=30，$\bar{x}\pm s$）
Tab. 3　Comparison of SBP and HR at different time between two groups　（n=30, $\bar{x}\pm s$）

组别	指标	T_0	T_1	T_2	T_3	T_4
M 组	SBP[a]	128.91±13.12[c]	126.44±13.53[c]	132.23±12.72	133.82±12.52	138.14±11.17
N 组	SBP[a]	137.32±11.75	135.84±16.42	139.15±14.23	140.44±15.53	140.12±13.11
M 组	心率[b]	76.71±9.98	76.92±9.76	77.66±10.15	75.93±11.93	73.74±10.53
N 组	心率[b]	75.03±9.34	74.64±14.81	75.04±11.33	74.42±10.72	73.07±10.82

注：[a]SBP(mmHg)；[b] 心率(次/min)；与 N 组比较，[c]P<0.05。

表 4　两组镇痛用药比较　（n=30）
Tab. 4　Comparison of analgesia consumption between two groups　（n=30）

组别	PCIA 按压次数 [$M(P_{25}, P_{75})$]	累计药物使用量 (mL, $\bar{x}\pm s$)	补救镇痛 [例(%)]
M 组	8(6,11)	40.33±5.10	3(10.0)
N 组	19(15,22)	90.83±7.01	8(26.67)
Z/χ^2 值	5.013	31.907	2.783
P 值	<0.001	<0.001	0.095

表 5　两组患者术后不良反应比较　[例(%)]
Tab. 5　Comparison of complications between two groups after surgery　[case(%)]

组别	例数	恶心	呕吐	皮肤瘙痒	头晕	嗜睡
M 组	30	2(6.67)	0	0	1(3.33)	0
N 组	30	5(16.67)	3(10.00)	2(6.67)	3(10.00)	1(3.33)
χ^2 值		0.647	1.404	0.517	0.268	
P 值		0.421	0.236	0.472	0.605	1.000[a]

注：[a] 采用 Fisher 确切概率法。

3　讨　论

Blanco 等[7]学者针对乳腺手术患者提出胸部神经阻滞的概念，并进而提出 PECS Ⅱ的镇痛方式。PECS Ⅰ型阻滞是将局部麻醉药注射在胸大肌和胸小肌之间的筋膜平面内，可阻滞胸内侧神经、胸外侧神经，为前上侧胸壁提供镇痛；PECS Ⅱ型阻滞是在 PECS Ⅰ的基础上将局麻药继续注射到胸小肌和前锯肌之间，增加阻滞范围，痛觉阻滞的皮节范围更广（胸 2 到胸 9 水平）[8]。

本研究两组患者术后 VAS 评分均低于 4 分，提示两种镇痛方式均可达到有效的术后镇痛效果。M 组患者在 T_0、T_1、T_2、T_3 时间点咳嗽时 VAS 评分低于 N 组患者，静脉镇痛药消耗量和补救镇痛次数显著少于 N 组，且未出现气胸、穿刺点血肿等神经阻滞相关并发症。以上结果提示胸部神经阻滞能够有效加强无背景剂量 PCIA 的镇痛效果，并能够减少静脉镇痛药物用量。

静脉用药联合神经阻滞镇痛的优势是发挥全身镇痛与局部镇痛的协同作用，减少药物不良反应[9]。对乳腺部分切除手术而言，约 30%的患者会在术后 24 h 经历中到重度疼痛的困扰[10]。PECS Ⅱ阻滞能够覆盖

乳腺部分切除术的手术区域。有学者报道前锯肌平面阻滞也可用于乳腺手术的术后镇痛[11]。前锯肌平面阻滞主要阻断胸部肋间神经侧皮支,主要提供前外侧及部分后胸部区域镇痛[12]。对于乳腺手术而言,前锯肌平面阻滞只能提供外下象限及部分外上象限的感觉阻滞,难以覆盖内上和内下象限[13]。由于常用局麻药物的半衰期均短于 24 h,因此单次神经阻滞常需配合口服或静脉镇痛药物等共同使用,以维持较长时间的镇痛效果。

传统的静脉自控镇痛泵的给药策略是持续的小背景给药剂量联合患者自控的按需少量给药,存在背景给药总剂量大,按需给药后镇痛不足的缺点。为了解决这一问题,无背景剂量 PCIA 的理念应运而生。无背景剂量是指不设置背景剂量,同时适当增加患者自控时的药物量,使得患者能够依据自身感受个性化的调控用药量,以达到减少药物总量和降低不良反应发生率的目的[14]。本研究中,两组患者术后不良反应发生率均较低,且两组间差异无统计学意义。这可能是因为对照组患者采用无背景剂量 PCIA,较传统镇痛泵减少了镇痛药物输注总量,进而降低了不良反应的发生率。

本研究存在一定的局限性:(1) 入组患者均为乳腺部分切除患者,疼痛创伤小于乳腺癌根治术等手术,今后需针对乳腺癌根治术患者进行研究,以验证本镇痛方案的有效性;(2) 随访时间较短,PECS Ⅱ阻滞对术后长期疼痛不适的影响不明确。

综上所述,乳腺部分切除患者术后应用超声引导下胸部神经阻滞联合无背景剂量 PCIA,可提供良好的术后镇痛且无明显并发症。

利益冲突　无

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