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ORIGINAL RESEARCH

Effect of Pericapsular Nerve Group Block with Wound Infiltration vs Modified Supra-Inguinal Fascia Iliaca Block on Postoperative Analgesia in Adult Patients Undergoing Total Hip Arthroplasty – A Randomized Clinical Trial

Ying Huang[1], Sheng Peng[1], Jun Wang[2], Lang Liu[2], Chun-Shan Dong[2]

[1] Department of Anesthesiology, Longhua Hospital Affiliated to Shanghai University of Traditional Chinese Medicine, Shanghai, People's Republic of China; [2] Department of Anesthesiology, Anhui Medical University Third Affiliated Hospital (Hefei First People's Hospital), Hefei, Anhui, People's Republic of China

Correspondence: Chun-Shan Dong, Department of Anesthesiology, Anhui Medical University Third Affiliated Hospital (Hefei First People's Hospital), Hefei Huaihe Road No. 390, 230061, People's Republic of China, Tel +86-13023030292, Email cxh0909@vip.126.com

Purpose: Pericapsular nerve group (PENG) block and supra-inguinal fascia iliaca block (S-FICB) provides incomplete analgesia for total hip arthroplasty (THA) due to anatomical limitations. This study compares two modified approaches—PENG block with wound infiltration (WI) and a modified S-FICB—to identify the optimal analgesic technique for THA.

Patients and Methods: Eighty-six subjects were randomly allocated to either the PENG block + WI group or the modified S-FICB group. The primary outcome was the postoperative numeric rating scale (NRS) pain scores (rest/hip adduction) at 6 hours. The secondary outcomes were pain scores at 12, 24, 48 hours postoperatively and postoperative day 5, the incidence of postoperative quadriceps motor block at 6, 12, 24, 48 hours and postoperative day 5, the mean blood pressure (MAP) at five time points, patient-controlled intravenous analgesia (PCIA) usage and adverse effects such as the incidence of rescue analgesia, local anesthetic systemic toxicity (LAST), postoperative hip infection, the incidence of postoperative nausea and vomiting (PONV) within 5 days after surgery.

Results: PENG + WI group had lower NRS at rest (6h) (95% CI 0.51–1.64, p<0.001). Compared with the PENG block + WI, the modified S-FICB resulted in a higher incidence of quadriceps motor block at 6 hours (82.1% vs 25.6%; OR=13.257, 95% CI 4.46–39.38; p<0.001) and 12 hours (71.8% vs 41%; OR=3.659, 95% CI 1.42–9.42; p=0.001).

Conclusion: PENG block + WI provides sufficient postoperative analgesia with no quadriceps motor block compared to modified S-FICB, supporting early ambulation and in line with the enhanced recovery after surgery (ERAS) protocols.

Keywords: total hip arthroplasty, nerve block, analgesia and anesthesia, enhanced recovery after surgery

Introduction

Total hip arthroplasty (THA) is a common surgical treatment for treating hip fractures and femoral head necrosis, which is often accompanied by severe pain.[1] Nociceptive nerves that cause hip pain are mainly innervated in the anterior capsule of the joint, which controlled by the joint branches of the femoral nerve (FN), obturator nerve (ON), and accessory obturator nerve (AON).[2] Additionally, surgical incision-related pain cannot be ignored and is mainly controlled by the lateral femoral cutaneous nerve (LFCN).[3] Peripheral nerve blocks have been used as part of a multimodal analgesic strategy.[4,5]

The supra-inguinal fascia iliaca block (S-FICB) has been widely used[6,7] and involves the FN, LFCN and ON, but its blocking effect of the ON is not clear.[8] Zheng et al and Huang et al[9,10] proposed a modified ultrasound-guided supra-inguinal fascia iliaca compartment block (modified S-FICB). Guided by the deep iliac circumflex artery, the needle was

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pushed from cephalad to caudad using an in-plane technique to puncture the iliac fascia, which improved satisfactory ON blockade. The pericapsular nerve group block (PENG block), a new regional block introduced by Girón–Arango et al,[11] blocks the joint branches of the FN, ON, and AON, providing satisfactory analgesia at the hip but not the surgical wound. This necessitates adjunctive wound infiltration (WI), where local anesthetics are administered directly into the surgical site post-procedure—a safe, motor-sparing method for postoperative pain relief.[12,13] While prior studies[14,15] reported comparable pain scores between S-FICB and PENG block, no blinded randomized trials have yet compared the modified S-FICB with PENG block with WI (PENG block + WI), both representing advancements in nerve block techniques.

Our primary objective was to assess the efficacy of PENG block + WI in postoperative analgesia and motor recovery and to compare its effectiveness with modified S-FICB. Our hypothesis was that PENG block + WI would have lower pain scores.

Material and Methods

The prospective trial was approved by the ethics committee of Hefei First People's Hospital (ID: 2022 [71]) on October 31, 2022, and registered in the Chinese Clinical Trial Registry (https://www.chictr.org.cn; Study ID: ChiCTR2200065321) on November 2, 2022, prior to patient recruitment. The study was conducted between November 5, 2022, and May 5, 2023, in accordance with the Declaration of Helsinki.

After obtaining written informed consent, we enrolled 86 patients scheduled to undergo THA. The inclusion criteria were as follows: scheduled for THA with lateral approach under general anesthesia, ASA I–III, aged ≥18 years, and no contraindication to regional anesthesia. The exclusion criteria were as follows: declined participation, coagulation disorders, septicemia or liver or renal failure, local anesthesia (LA) allergy, pregnancy and chronic preoperative opioid use.

Intervention, Randomization and Blinding

Patients were randomized 1:1 to either the PENG block + WI group or modified S-FICB group using a computer-generated sequence. Allocation was concealed in sealed envelopes managed by an independent research assistant. On the day of surgery, an unblinded investigator assigned patients to the PENG block + WI group: PENG block (10 mL 0.5% ropivacaine) + wound infiltration (20 mL 0.25% ropivacaine) or the modified S-FICB group: Modified S-FICB (40 mL 0.25% ropivacaine). The operating room nurse prepared solutions based on group assignment. Surgeons, postoperative assessors, and patients remained blinded to group allocation.

Anesthesia Management

All patients fasted from heavy meals for 8 hours, light meals for 6 hours and from clear liquids for 4 hours before surgery. Upon arrival in the monitoring and treatment room, venous access was established, and blood pressure, heart rate, and oxygen saturation were monitored. Both groups received mild sedation with intravenous dexmedetomidine (0.6 μg/kg) over 20 minutes. A radial artery puncture was performed for patients with an ASA III and hemodynamic instability. Under routine monitoring, nerve blocks were conducted using ultrasound (Navi s, Wisonic, Shenzhen, China) by a senior anesthesiologist, followed by anesthesia induction. General anesthesia was induced with propofol (1.2–2 mg/kg), sufentanil (0.3–0.5 μg/kg), and rocuronium bromide (0.6 mg/kg), and maintained with propofol (2–5 mg/kg/h), remifentanil (0.1–0.5 μg/kg/min), and sevoflurane (1%), targeting a bispectral index (BIS) of 40–60.

In the PENG block + WI group, 20 mL of 0.25% ropivacaine was administered via surgical wound infiltration postoperatively, whereas the modified S-FICB group received 20 mL of 0.9% normal saline. Both groups received identical postoperative multimodal analgesia: flurbiprofen axetil (50 mg) and sufentanil (5 μg) 5 minutes preoperatively, followed by patient-controlled intravenous analgesia (PCIA). The PCIA regimen included sufentanil (100 μg), ondansetron (8 mg), and dexmedetomidine (2–3 μg/kg) in 100 mL normal saline, initiated preoperatively with a 5 mL bolus, 3 mL/h background infusion, 2 mL patient-controlled doses, and a 20-minute lockout interval. Postoperatively, parecoxib sodium (40 mg/24 h) was administered intravenously for 48 hours. Rescue analgesia (oral tramadol 50 mg) was provided if numeric rating scale (NRS) pain scores reached ≥5.

Performance of Nerve Blocks

All blocks were performed preinduction with patients supine. For the modified S-FICB, according to the technique described by Zheng et al and HUANG Yonghua,[9,10] the anterior superior iliac spine was palpated, and the high-frequency linear ultrasound probe (5–10 MHz) (Navi, Wisonic, Shenzhen China) was placed at the patient's navel to obtain an image of the anterior superior iliac spine and the iliac muscle was identified by sliding the probe inwards. Then, the probe was adjusted to identify the subcutaneous tissue, internal oblique muscle, sartorius muscle, fascia iliaca, and iliac muscle. The inner side of the probe was fixed, the outer side of the probe was rotated approximately 15° inwards, and color Doppler localized the deep iliac circumflex artery overlying the fascia iliaca. Guided by the deep iliac circumflex artery, the needle was pushed from cephalad to caudad using an in-plane technique to puncture the iliac fascia (Figure 1a). We administered 2–3 mL of physiological saline, observed the downwards movement of the iliac muscle, and then withdrew and injected 40 mL of 0.25% ropivacaine in batches (Figure 1a). Sensory loss on the lateral/anterior thigh (assessed via pinprick 15 min postinjection) defined successful blockade. Failed blocks were excluded. For the PENG block, according to the technique described by Giron-Arango,[11] a curvilinear probe was used (5–10 MHz) for ultrasound (Navi, Wisonic, Shenzhen China).

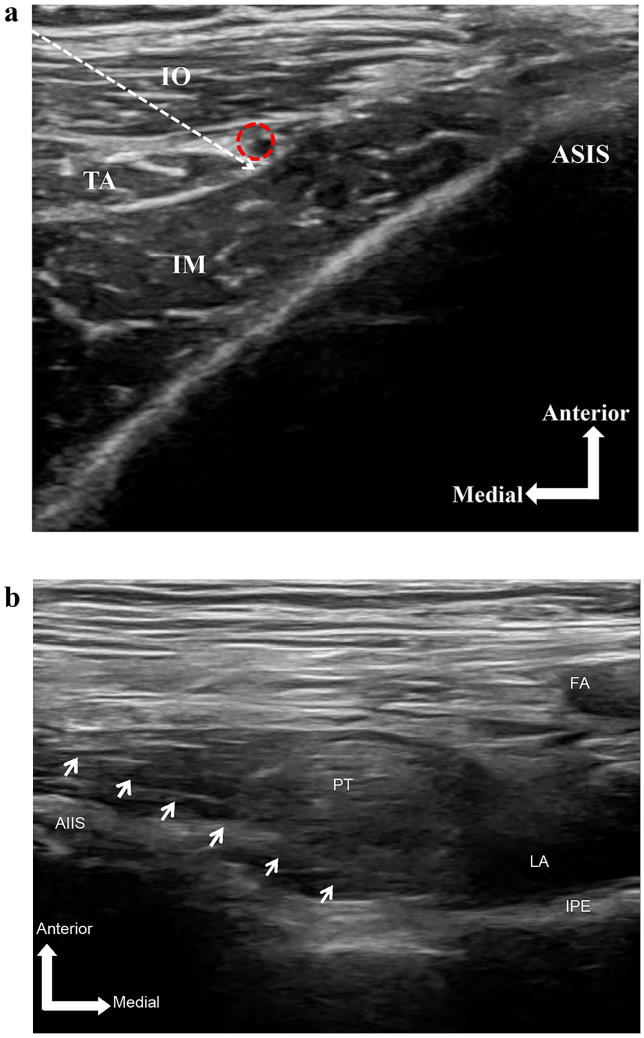

Figure 1 (**a**) Ultrasound image for identification of the relevant structures for modified suprainguinal fascia iliaca block (modified S-FICB). The needle tip was located under the fascia iliacus between the deep iliac circumflex artery and iliac muscle. Dashed arrow, needle pathway; red area circled by dashed line, deep iliac circumflex artery. (**b**) Images of ultrasound-guided pericapsular nerve group (PENG) block. The needle tip was positioned between the psoas tendon and the pubic ramus using an in-plane approach. The needle is outlined by the arrows; arrow, needle pathway.

Abbreviations: IO, internal oblique muscle; TA, transverse abdominus muscle, IM, iliacus muscle; ASIS, anterior superior iliac spine; LA, local anesthetic; AIIS, anterior inferior iliac spine; IPE, iliopubic eminence; PT, psoas tendon; FA, femoral artery.

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Puncture was performed in a lateromedial direction until the needle tip reached the plane between the iliopsoas tendon and periosteum and between the anterior inferior iliac spine and iliopubic eminence. After a negative aspiration test, 10 mL of 0.5% ropivacaine was injected in the plane beneath the iliopsoas muscle to obtain an image of the psoas tendon uplift (Figure 1b). Two blinded anesthesiologists (5+ years of regional anesthesia experience) performed all blocks.

Study Outcomes

Our primary outcome was the postoperative NRS pain scores (0 no pain, 10 worst imaginable pain) at rest and during adduction at 6 hours. The secondary outcomes were static (at rest) and dynamic (hip adduction) pain scores at 12, 24, 48 hours and day 5, the incidence of postoperative quadriceps motor block (paralysis or paresis) at 6, 12, 24 48 hours and day 5, the mean blood pressure (MAP) at five time points: T1: admission; T2: 3 minutes after induction; T3: positioning; T4: skin incision; T5: 5 minutes after extubation in the operation room, perioperative anesthetic and vasoactive drug use, the incidence of rescue analgesia, PCIA usage and adverse effects such as local anesthetic systemic toxicity (LAST), postoperative hip infection, the incidence of postoperative nausea and vomiting (PONV) within 5 days. All the study variables we collect are real-time.

Patients were positioned supine with hips and knees flexed at 45° and 90°, respectively, using the knee extension test. The patient was first asked to extend the knee against gravity and then against resistance. Knee extension was graded according to a 3-point scale: 0=normal strength (extension against gravity and against resistance); 1=paresis (extension against gravity but not against resistance); and 2=paralysis (no extension possible).[16]

Statistical Analysis

To calculate the sample size, we considered our primary hypothesis that the patients who underwent PENG block + WI would have lower pain scores than those who underwent the modified S-FICB. Previous publications[9,10] showed that the pain scores of the patients who underwent the S-FICB was approximately 1.7 (SD 0.7) at rest at 6 hours postoperatively. In our preliminary experiment, we estimated the mean pain score and the SD of the patients who underwent the PENG block + WI would be 1 and 1, respectively. To obtain a study power of 80%, we selected an SD of 1 for both groups and a type 1 error of 5%. We calculated that at least 34 patients were needed per group. We decided to recruit 90 patients in total in case of any exclusions and patients lost to follow-up.

Parametricity of continuous variables was evaluated using the Shapiro–Wilk normality test. Normally distributed continuous variables are expressed as the mean with SD, and non-parametric variables are expressed as the median (IQR [range]). For continuous parametric variables, Student's t test was used, while the Wilcoxon-Mann–Whitney U-test was used for non-parametric continuous variables. Generalized estimating equation approaches was applied to compare the NRS among groups. The results were expressed by P value and 95% confidence index (CI). For categorical data, the χ^2-test was used. Fisher's exact test was used when any cell for the aforementioned categorical data had an expected count of less than five, and univariate logistic regression was used to calculate the odds ratio and 95% CI for postoperative quadriceps motor block. Repeated measures analysis of variance and Student's t test were used to compare MAP at five time points. P value < 0.05 was considered statistically significant.

Results

Of 90 screened patients, 4 patients refused to sign informed consent forms and thus were not included. Eighty-six patients were randomized equally into two groups (Figure 2). Four subjects in the modified S-FICB group (nerve block failure) and four in the PENG + WI group (3 early discharges, 1 non-compliance with strength testing) were excluded, leaving 39 subjects per group for analysis (Figure 2). Demographic characteristics were comparable between groups (Table 1).

Compared with the modified S-FICB group, the PENG block + WI group demonstrated significantly lower NRS scores at rest at 6 hours postoperatively (95% CI 0.51–1.64, p<0.001 Table 2), with a median (IQR [range]) of 1 (0–2 [0–5]) vs 2 (2–3 [1–6]). Similarly, the PENG block + WI group exhibited reduced NRS scores during hip adduction at both 6 hours (95% CI 0.27–1.47, p=0.004) and 12 hours postoperatively (95% CI 0.04–1.29, p=0.037 Table 2). In addition, modified S-FICB group showed significantly lower mean arterial pressure (MAP) at T4 (P < 0.05, Figure 3), with no inter-group differences at other time points.

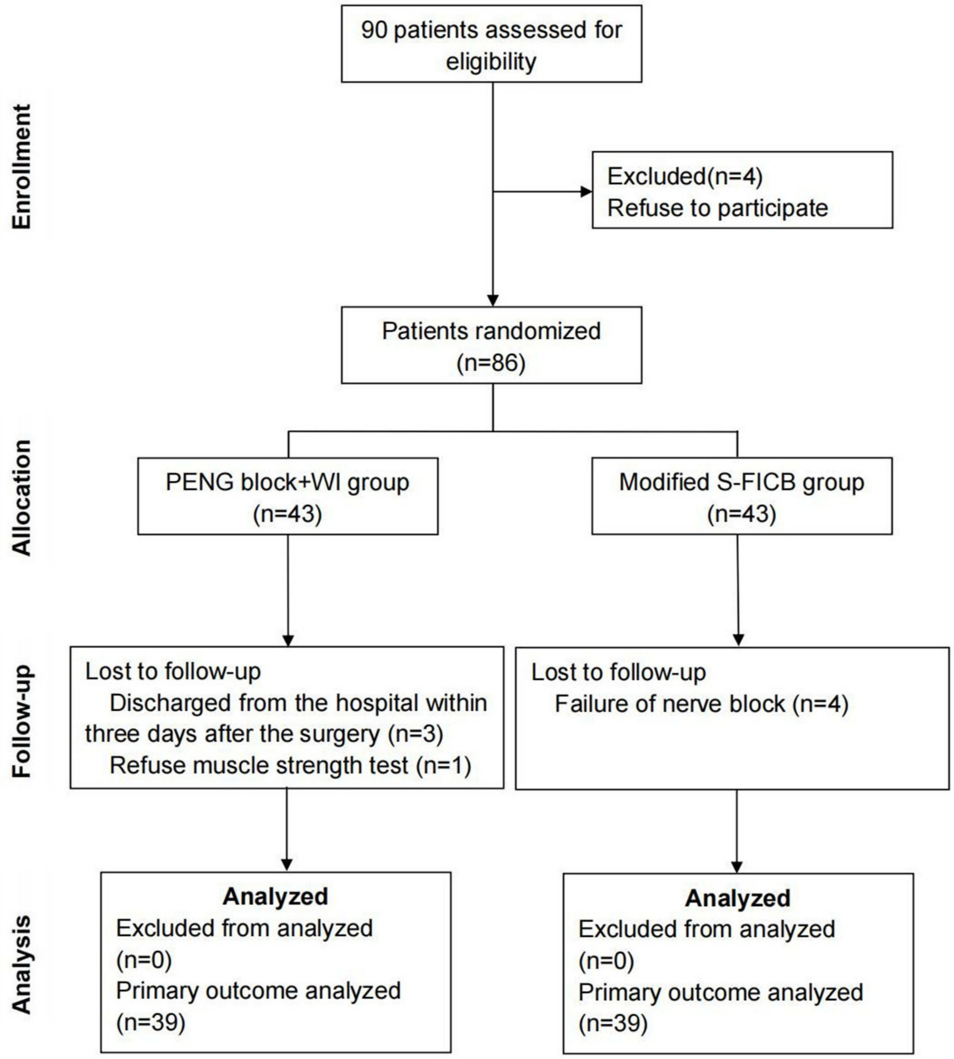

Figure 2 Flow diagram of the patients' recruitment.

Compared with the PENG block + WI, the modified S-FICB resulted in a higher incidence of quadriceps motor block at 6 hours (82.1% vs 25.6%; OR=13.257, 95% CI 4.46–39.38; p<0.001) and 12 hours (71.8% vs 41%; OR=3.659, 95% CI 1.42–9.42; p=0.001) (Table 3), with no inter-group differences at other time points.

No inter-group differences were found in terms of intraoperative opioids and vasoactive drug consumption or the incidence of rescue analgesia, PCIA usage, LAST, PONV or postoperative hip infection (Table 4).

Discussion

Our randomized trial demonstrated that the addition of WI to PENG block provided sufficient postoperative analgesia with no motor block in patients undergoing THA with lateral approach.

Hip surgeries, particularly for fractures, are associated with moderate-to-severe perioperative pain.[4] Adequate pain management can facilitate postoperative mobilization and promote functional recovery,[17,18] which is an important component of the enhanced recovery after surgery (ERAS) protocols. While prior studies[14,15] reported comparable analgesia between PENG block and supra-inguinal fascia iliaca compartment block (S-FICB), both techniques have limitations. For S-FICB, whether the ON is involved is rather controversial.[19] And multiple studies have shown that the obturator nerve is not completely located within the iliac fascia compartment,[20,21] which means that its analgesic effect can be limited by sparing of the anteromedial side of the hip joint. In addition, although PENG block is a nerve block

Table 1 Demographic Data and Patient Characteristics

	PENGB + WI (n=39)	Modified S-FICB (n=39)	P Value
Sex, n (%)			
Female	19 (49)	22 (56)	0.650
Male	20 (51)	17 (44)	
Age (years)	69.23 (6.21)	66.95 (9.81)	0.224
BMI (kg/m^2)	22.75	23.50	0.583
ASA status (II/III)	21/18	19/20	0.821
Surgery duration (min)	75.28	78.51	0.621
Preoperative diagnosis, n (%)			
Fracture	20 (51)	25 (64)	0.359
Femoral head necrosis	19 (49)	14 (36)	

Notes: Data are presented as mean (SD) or number (proportion).
Abbreviations: BMI, body mass index; ASA, American Society of Anesthesiologists; PENGB + WI, pericapsular nerve block with wound infiltration; Modified S-FICB, modified supra-inguinal fascia iliaca block.

Table 2 Postoperative Static and Dynamic Pain Scores

	PENGB + WI	Modified S-FICB	95% CI	P Value
Pain 6-hour static (NRS)	1 (0–2 [0 −5])	2 (2–3 [1 −6])	0.51–1.64	<0.001 *
Pain 6-hour dynamic (NRS)	2 (1–3 [0 −6])	3 (2–4 [1 −7])	0.27–1.47	0.004 *
Pain 12-hour static (NRS)	1 (1–2 [0 −6])	2 (1–3 [0 −7])	0.03–1.27	0.064
Pain 12-hour dynamic (NRS)	2 (1–3 [0 −7])	3 (2–4 [1 −7])	0.04–1.29	0.037 *
Pain 24-hour static (NRS)	2 (1 −3 [0 −5])	2 (2–3 [0 −6])	0.07–1.05	0.089
Pain 24-hour dynamic (NRS)	2 (2–3 [0 −5])	2 (2–4 [1 −6])	0.08–1.05	0.091
Pain 48-hour static (NRS)	1 (0 −2 [0 −3])	1 (1–2 [0 −3])	0.09–0.70	0.128
Pain 48-hour dynamic (NRS)	2 (1–2 [0 −5])	1 (1–2 [0 −3])	0.21–0.72	0.281
Pain 5-d static (NRS)	0 (0 −1 [0 −3])	1 (0–2 [0 −3])	0.16–0.67	0.228
Pain 5-d dynamic (NRS)	0 (0–1 [0 −3])	1 (0–2 [0 −3])	0.16–0.67	0.228

Notes: Data are presented as median (IQR [range]). *denotes statistical significance ($p < 0.05$).
Abbreviations: NRS, numeric rating scale; PENGB + WI, pericapsular nerve block with wound infiltration; Modified S-FICB, modified supra-inguinal fascia iliaca block; CI, Confidence interval.

technique for intracapsular analgesia of the hip joint,[11] it spares the LFCN, failing to address incision-site pain. Some researchers have suggested combining PENG block with LFCN block to provide a better analgesic effect than PENG block alone.[22] Modified S-FICB is guided by the deep iliac circumflex artery. The needle was pushed from cephalad to caudad using an in-plane technique to puncture the iliac fascia, providing satisfactory blockade FN, ON and sciatic nerves (SN), especially for ON.[9,10] WI complements the PENG block by addressing its inability to anesthetize the surgical incision. Therefore, this study directly compared these optimized approaches to redefine postoperative analgesia strategies for THA.

Both groups achieved consistently low postoperative pain scores. S-FICB relies on volume-dependent diffusion, with previous studies[14,23] supporting 40 mL of low-concentration ropivacaine. While PENG block targets a confined anatomical space, requiring smaller volumes. Previous studies[24–26] have shown that 10 mL local anesthetic is sufficient to provide postoperative analgesia. To standardize total ropivacaine doses (100 mg), we administered: 40 mL 0.25% ropivacaine for S-FICB; 10 mL 0.5% ropivacaine for PENG block +20 mL 0.25% ropivacaine for WI. This approach aligned with evidence-based dosing while maintaining efficacy. Current guidelines[27] emphasize multimodal analgesia combining regional blocks, non-opioids, and selective COX-2 inhibitors. By integrating optimized nerve blocks into this framework—targeting gaps in existing techniques (variable obturator coverage of S-FICB and lacking of incision analgesia for PENG block)—we validated a feasible, motor-sparing strategy for THA. However, it is crucial to consider

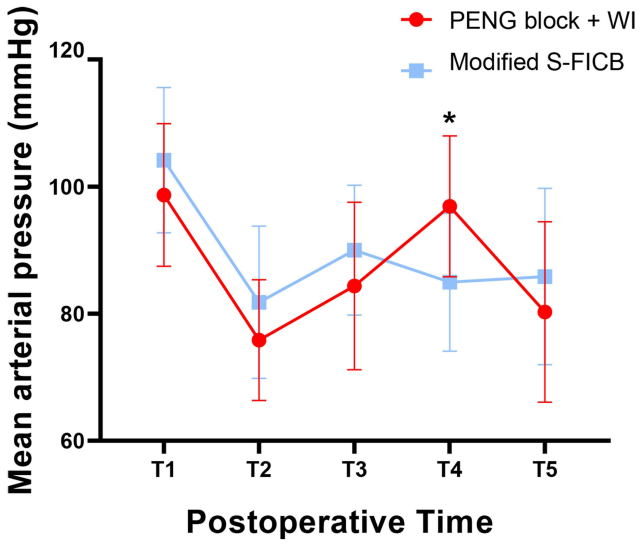

Figure 3 Changes in mean arterial pressure. T1: admission; T2: 3 minutes after induction; T3: positioning; T4: skin incision; T5: 5 min after extubation in PACU. *denotes statistical significance ($p < 0.05$).
Abbreviations: PENG + WI, pericapsular nerve group block with wound infiltration; Modified S-FICB, modified suprainguinal fascia iliaca block.

whether the observed statistical differences in pain scores (NRS < 4) at 6 and 12 hours postoperatively carry substantial clinical significance. Three key arguments support the limited clinical relevance of these numerical differences. Firstly, comparable PCIA consumption and rescue analgesia incidence between groups indicate similar clinical needs. This phenomenon likely reflects achievement of the clinical target of "adequate analgesia" in both groups.[28] Secondly, pain scales exhibit reduced discriminative validity at lower scores (NRS < 4). Studies[29] have demonstrated reduced patient discrimination accuracy when NRS <4, suggesting these minor differences may not represent true clinical differentiation. Finally, from a clinical perspective, the primary objectives of pain management are to prevent moderate-to-severe pain (NRS ≥4) while minimizing analgesic-related adverse effects. When both groups achieved the predefined pain control target (NRS < 4) with comparable requirements for supplemental analgesia, the marginal numerical differences should not serve as primary determinants of therapeutic superiority.[30] Pain management should prioritize functional outcomes and safety profiles over pursuit of statistically significant differences within clinically equivalent mild pain ranges.[31]

Our results revealed elevated blood pressure in the PENG + WI group following skin incision. Previous study[32] suggested that pain activates the sympathetic nervous system, and hypertension may reflect inadequate intraoperative analgesia. While the modified S-FICB stabilized blood pressure post-blockade of the lateral femoral cutaneous nerve, the PENG + WI group's hypertensive response suggests incomplete nociceptive inhibition during incision.

The PENG block + WI group exhibited superior postoperative quadriceps muscle strength compared to controls, consistent with prior studies.[33,34] Notably, no patients in the PENG + WI group experienced complete motor block, contrasting with earlier

Table 3 Postoperative Motor Block Assessment

Postoperative Motor Outcomes	PENGB +WI			Modified S-FICB			OR	95% CI	P Value
	Absent	Reduced	Intact	Absent	Reduced	Intact			
Quadriceps strength at 6 hour, n (%)	0(0.0)	10(25.6)	29(74.4)	18(46.2)	14(35.9)	7(17.9)	13.257	4.46–39.38	<0.001 *
Quadriceps strength at 12 hour, n (%)	0(0.0)	16(41.0)	23(59.0)	9(23.1)	19(48.7)	11(28.2)	3.659	1.42–9.42	0.001 *
Quadriceps strength at 24 hour, n (%)	0(0.0)	5(12.8)	34(87.2)	2(5.1)	9(23.1)	28(71.8)	2.671	0.83–8.60	0.190
Quadriceps strength at 48 hour, n (%)	0(0.0)	2(5.1)	37(94.9)	0(0.0)	6(15.4)	33(84.6)	3.364	0.64–17.83	0.263
Quadriceps strength at 5 d, n (%)	0(0.0)	0(0.0)	39(100)	0(0.0)	0(0.0)	39(100)	/	/	1.00

Notes: Values are number (proportion). *denotes statistical significance ($p < 0.05$).
Abbreviations: PENGB + WI, pericapsular nerve block with wound infiltration; Modified S-FICB, modified supra-inguinal fascia iliaca block; OR, Odds ratio; CI, Confidence interval.

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Table 4 Intraoperative Drugs Consumption and Other Postoperative Outcomes

	PENGB + WI (n=39)	Modified S-FICB (n=39)	P Value
Intraoperative propofol consumption (mg)	147.25 (58.79)	174.22(64.1)	0.06
Intraoperative remifentanil consumption (mg)	0.39 (0.16)	0.38 (0.17)	0.76
Intraoperative atropine consumption (mg)	0.27 (0.35)	0.17 (0.30)	0.20
Intraoperative dopamine consumption (mg)	2.33 (4.6)	4.14 (6.10)	0.14
Intraoperative norepinephrine consumption (mg)	0.046 (0.96)	0.50 (0.13)	0.89
Rescue analgesic, n (%)	8 (20.5)	12 (30.8)	0.44
PCIA usage (mL)	90.54 (5.13)	89.85 (4.80)	0.54
PONV, n (%)	10 (25.6)	14 (35.9)	0.46
Postoperative hip infection, n (%)	0 (0)	0 (0)	1.00
LAST, n (%)	0 (0)	0 (0)	1.00

Notes: Values are mean (SD) or number (proportion).
Abbreviations: PCIA, patient-controlled intravenous analgesia; PONV, postoperative nausea and vomiting; LAST, local anesthetic systemic toxicity; PENGB + WI, pericapsular nerve block with wound infiltration; Modified S-FICB, modified supra-inguinal fascia iliaca block.

studies. This may be explained as follows: First, administration of 10 mL 0.5% ropivacaine in our study (vs 20 mL in prior studies[33,34]), aligning with evidence that motor-sparing effects of PENG blocks depend critically on injectate volume.[35,36] Second, postoperative pain at the surgical incision cannot be ignored. Pain is also an important factor affecting postoperative activity.[17,18] Incisional infiltration in our study provided targeted analgesia at the surgical site without impairing quadriceps function.[12,13] Preserved quadriceps strength mitigates patient-reported dissatisfaction (inability to lift legs, numbness). Therefore, early postoperative motor rehabilitation management is crucial. The PENG block offers distinct advantages, including a lower required dose of local anesthetic, rapid onset, and the absence of motor blockade.[37,38] These benefits facilitate early postoperative ambulation, aligning with the principles of ERAS protocols.

However, this study has some limitations. First, the time between modified S-FICB and surgical initiation was not recorded, which may have influenced blood pressure fluctuations during patient positioning and skin incision. Second, since the outcome here is pain scores, the baseline pain scores were not recorded nor were the type of painkillers that were consumed during their stay in the ward, in addition, we did not record the use of rescue analgesics, only the incidence of rescue analgesia. All of these will affect our postoperative comparison of pain scores with the two groups. Third, factors such as frailty and days between fracture and surgery need to be very balanced between the study groups to avoid bias. Fourth, the time of first ambulation and discharge should be recorded in order to better elaborate the ERAS protocols.

Conclusion

In summary, PENG block + WI provides sufficient postoperative analgesia with no quadriceps motor block for THA compared to modified S-FICB, supporting early ambulation and in line with the enhanced recovery ERAS protocols.

Data Sharing Statement

Raw data (de-identified) used in this clinical trial are available from the corresponding author Chun-Shan Dong.

Ethics Statement

This is a randomized controlled clinical trial comparing the analgesic effect of pericapsular nerve group block of hip joint with different concentrations and volumes of ropivacaine in elderly patients undergoing hip replacement. This study conforms with Helsinki Declaration.

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Disclosure

The authors declare no competing interests in this work.

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