Preoperative Analgesic Effect of Fascia Iliaca Block in Geriatric Hip Fracture, a Randomized Controlled Trial

ผลการระงับปวดก่อนผ่าตัดด้วย Fascia Iliaca Block ในผู้ป่วยสูงอายุที่กระดูกสะโพกหัก การศึกษาแบบสุ่มที่มีการควบคุม

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Abstract

Objective: This study aims to identify the preoperative analgesic effects of fascia iliaca block in geriatric hip fractures.

Methods: The study design was a prospective randomized controlled trial focused on hip fracture patients aged between 60 and 90 years from July to December 2023. Participants were randomly assigned to two groups: the first received standard analgesia (control group), while the second underwent fascia iliaca block with 30 ml of 0.33% bupivacaine at protocol initiation (FICB group). Numerical pain rating scale (NRS) and opioid consumption were recorded.

Result: Forty-seven participants were analyzed. At 24 hours, FICB group exhibited significantly ($p < .001$) lower mean NRS at rest (0.5 ± 0.8 vs 2.4 ± 1.3) and during movement (2.9 ± 1.1 vs 5.6 ± 1.5), with substantially lower in opioid consumption compared to the control group (0.1 ± 0.3 vs 1.5 ± 1.3 mg).

At 48 hours, FICB group maintained lower mean NRS, along with a higher percentage of ambulation on bed (82.6% vs 20.8%). Although delirium and pneumonia incidence was lower in the FICB group, the difference was not statistically significant.

Conclusion: The fascia Iliaca block exhibited preoperative analgesic effects, facilitated patient ambulation, and potentially reduced complications associated with uncontrolled pain in geriatric hip fractures.

Keyword: fascia iliaca block, geriatric hip fracture, preoperative pain management
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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาผลการระงับปวดก่อนผ่าตัดด้วย fascia iliaca block ในผู้สูงอายุที่มีกระดูกสะโพกหัก

วิธีการศึกษา: การศึกษาแบบไปข้างหน้าด้วยวิธีการสุ่มแบบมีกลุ่มควบคุม ดำเนินการตั้งแต่เดือนกรกฎาคม พ.ศ. 2566 จนถึงเดือนธันวาคม พ.ศ. 2566 อาสาสมัครได้แก่ ผู้ป่วยกระดูกสะโพกหักที่อายุตั้งแต่ 60 ถึง 90 ปี อาสาสมัครได้รับการสุ่มออกเป็นสองกลุ่ม โดยกลุ่มควบคุมจะได้รับการรักษาด้วยยาแก้ปวดตามมาตรฐาน และกลุ่ม FICB จะได้รับการทำ fascia iliaca block ด้วยยาชาความเข้มข้น 0.33% bupivacaine ปริมาตร 30 มิลลิลิตร หลังจากเข้าโครงการมีการติดตามคะแนนความปวดและปริมาณการใช้ยากลุ่ม opioids

ผลการศึกษา: อาสาสมัคร 47 ราย ได้รับการวิเคราะห์ที่ 24 ชั่วโมงหลังเข้าร่วมโครงการ อาสาสมัครในกลุ่ม FICB มีคะแนนเฉลี่ยความปวดน้อยกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ $p < .001$ ทั้งคะแนนความปวดขณะพัก (0.5 ± 0.8 กับ 2.4 ± 1.3) และคะแนนความปวดขณะเคลื่อนไหว (2.9 ± 1.1 กับ 5.6 ± 1.5) รวมทั้งมีปริมาณการใช้ opioids น้อยกว่ากลุ่มควบคุม (0.1 ± 0.3 กับ 1.5 ± 1.3 มิลลิกรัม)

ที่ 48 ชั่วโมงคะแนนความปวดของกลุ่ม FICB ยังคงลดลง ทั้งนี้ร้อยละการเคลื่อนไหวบนเตียงของผู้ป่วยในกลุ่ม FICB มีค่าสูงกว่ากลุ่มควบคุม (82.6% vs 20.8%) นอกจากนี้ภาวะเพ้อสับสนและปอดอักเสบมีค่าน้อยกว่าในกลุ่ม FICB แต่ไม่มีนัยสำคัญทางสถิติ

สรุป: การระงับปวดด้วย fascia iliaca block ช่วยลดอาการปวดก่อนผ่าตัดให้กับผู้สูงอายุที่มีกระดูกสะโพกหักได้ นอกจากนี้ยังมีส่วนช่วยทำให้ผู้ป่วยสามารถเคลื่อนไหวร่างกายได้มากขึ้น และมีแนวโน้มที่จะลดการเกิดภาวะแทรกซ้อนจากอาการปวดรุนแรงได้

คำสำคัญ: การจัดการความปวดก่อนผ่าตัด การฉีดยาชาระงับความรู้สึกบริเวณสะโพก กระดูกสะโพกหักในผู้สูงอายุ
วารสารแพทย์เขต 4-5 2567 ; 43(1) : 49–59.

Introduction

Geriatric hip fractures elicit profound pain in patients[1], contributing to morbidity and mortality marked by complications such as pneumonia, bed sores, sepsis, and delirium[2]. The challenge of pain management in the elderly stems from medication limitations, particularly the use of NSAIDs due to the potential risk of complications. Elderly patients often exhibit diminished renal function, thereby restricting NSAID application. While opioids can be used, they are associated with the risk of inducing delirium and respiratory depression[3]. The assessment of pain in the elderly is further complicated by the prevalent impairment of cognitive function[4]. In this context, regional anesthesia, specifically the fascia iliaca block, emerges as a pivotal component in geriatric pain control. This technique involves the precise administration of a local anesthetic below the fascia iliaca, enveloping both the femoral nerve and the lateral femoral cutaneous nerve of the

thigh[5]. Since 2007, Fossa[6] has implemented the fascia iliaca block for preoperative pain management in hip fractures, revealing its efficacy in diminishing opioid consumption and alleviating postoperative pain. However, in 2018, Steenberg[7] published the systematic review of preoperative advantages of the fascia iliaca block. A notable limitation of this study was the restricted 24-hour patient follow-up period.

This study aims to identify the preoperative analgesic effects of the fascia iliaca block in geriatric hip fractures. The findings are anticipated to provide valuable insights for enhancing analgesic care tailored to this specific demographic group.

Method

We conducted a prospective randomized controlled trial at Nakhonpathom Hospital after obtaining ethical approval from Institutional Review Board No. 024/2023 and written informed consent. Data collection occurred from July 2023 to December 2023.

Inclusion criteria encompassed patients aged 60–90 with closed hip fractures, ASA classification I–III, no associated injuries, no previous chronic hip pain, and ability to use a numerical pain rating scale (NRS).

Exclusion criteria included patient refusal, local anesthetic drug allergy, failed block (NRS reduction less than 50%), coagulopathy, fractures exceeding 24 hours, surgery performed before 24 hours, and body weight less than 33 kg.

Based on the study by Diakomi et al[8], with a mean pain score of 2.2 (SD 2.3) for the block group and 5.2 (SD 2.1) for the control group, a power of 90%, and a type I error of 0.01 using the G*Power 3.1.9.4 program, the calculated sample size was 21 participants for each group. To account for potential data loss and dropouts, the sample size was increased by 20%, resulting in a final sample size of 25 participants for each group.

The primary outcome was the average numerical pain rating scale (NRS) at 24 hours following the protocol. The secondary outcomes included opioid consumption at 24 and 48 hours, NRS at 48 hours, percentage of ambulation, satisfactory score (0 = unsatisfied, 10 = maximal satisfied), and incidence of delirium and pneumonia.

After admission to the orthopedic inpatient department (IPD), all geriatric hip fracture patients meeting the inclusion criteria were informed and provided consent before being randomized using a random code. The control group received pain control with oral paracetamol 500 mg every 6 hours and intravenous morphine as needed. The FICB group received a fascia iliaca block with 30 ml of 0.33% bupivacaine at the protocol's initiation, along with oral paracetamol and intravenous morphine as needed. Morphine administered intravenously was adjusted based on the severity of pain. A dose of 2 mg was administered for severe pain (NRS 7–10), while 1 mg was given for moderate pain (NRS 4–6).

The fascia iliaca block was performed in the operating room's recovery area. Upon the patient's arrival, an anesthetist nurse monitored NIBP, SpO2, and EKG. The experienced anesthesiologist, with over 1 year of expertise in performing the fascia iliaca block using the supra-inguinal approach, prepared two syringes totaling 30 ml by mixing 10 ml of 0.5% bupivacaine with 5 ml of normal saline solution (NSS). Employing sterile techniques, the anesthesiologist used ultrasound (GE Logiq e version) with linear probe to identify key structures: fascia iliaca, deep circumflex femoral artery, and iliacus muscle.

The skin was cleaned with chlorhexidine, and 2–3 ml of 2% xylocaine was injected for skin infiltration. The 22 gauge 80 mm stimuplex needle was positioned between the fascia iliaca and iliacus muscle, allowing drug injection to separate the fascia and muscle layers, while elevating the deep circumflex femoral artery (Figure 1). Sliding the ultrasound medially revealed the spread of local anesthesia around the femoral nerve (Figure 2), confirmed the success of the block. Following the block, participants, vital signs were monitored in the recovery room for 30 minutes before being transferred to the wards.

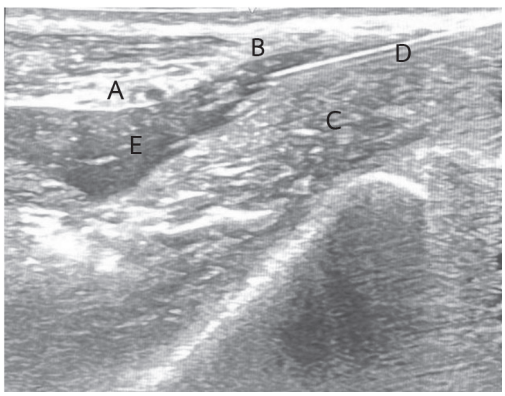

Figure 1 : Distribution of local anesthetic between fascia and iliacus muscle

A: deep circumflex femoral artery
B: fascia iliaca
C: iliacus muscle
D: needle
E: local anesthetic

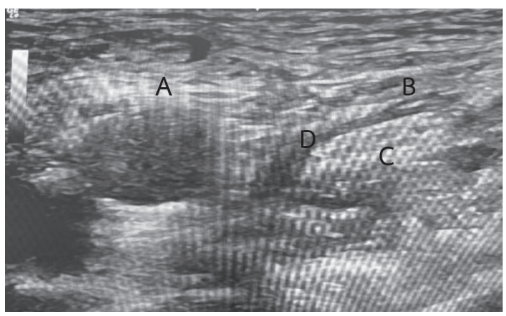

Figure 2 : Distribution of local anesthetic around femoral nerve

A: femoral vein
B: fascia iliaca
C: femoral nerve
D: local anesthetic

Demographic data including sex, age, BMI, ASA classification, comorbidity disease, type of fracture, and skin traction were recorded through chart review. Pain scores were evaluated using a numerical pain rating scale (NRS) at the protocol's initiation, 30 minutes post-block, and at 24 and 48 hours afterward by nurse anesthetists, assessing at rest and during movement (rolling hip). Additionally, opioid consumption, ambulation levels at 48 hours, satisfactory scores, and complications related to uncontrolled pain, such as delirium and pneumonia were documented.

All data analysis was performed using SPSS for Windows version 22.0. Demographic data were analyzed using descriptive statistics, presenting numbers and percentages, means, and standard deviations. Pain scores and opioid consumption were reported with mean and standard deviation. Statistical analysis included the use of chi-square test or Fisher's exact test for categorical variables and unpaired samples t tests for continuous variable comparisons between two groups.

Result

Fifty participants were enrolled. One participant from control group and two participants from FICB group were excluded as they underwent surgery within 24 hours of joining the protocol. Therefore, the analysis included a total of forty-seven participants.

The demographic data of both groups including sex, age, BMI, ASA classification, comorbidity diseases, type of fracture, and skin traction incidence did not exhibit significant differences, as shown in Table 1. The mean NRS at rest at the initial protocol between both groups was not significantly different. However, the mean NRS during movement was significantly higher in the FICB group (Table 2). For participants in the FICB group, the waiting time for participants in the FICB group to receive the fascia iliaca block after joining the protocol was approximately 92 minutes with a variability of ± 46 minutes.

Table 1: Demographic data

Demographic data	Control group N = 24, n (%)	FICB group N = 23, n (%)	p-value
Age (year), mean ± SD	78.21 ± 7.48	74.74 ± 7.15	.111
BMI (kg/m^2), mean ± SD	22.14 ± 4.26	21.88 ± 3.73	.824
Sex (Male)	10 (41.7)	9 (39.1)	.859
Type of fracture			
Neck of femur	11 (45.8)	13 (56.5)	.378
Intertrochanteric	9 (37.5)	9 (39.1)	
Subtrochanteric	4 (16.7)	1 (4.3)	

* Significant at p < .01

Table 1: Demographic data (continued)

Demographic data	Control group N = 24, n (%)	FICB group N = 23, n (%)	p-value
Comorbidity disease			
Cardiovascular	9 (37.5)	12 (52.2)	.312
Neurology	4 (16.7)	8 (34.8)	.154
Endocrine	8 (33.3)	2 (8.7)	.039
Renal	3 (12.5)	1 (4.3)	.317
ASA class (%)			
2	17 (70.8)	14 (60.9)	.471
3	7 (29.2)	9 (39.1)	
Skin traction	23 (95.8)	22 (95.7)	.975

* Significant at p < .01

At the beginning of protocol 92% of participants were experienced of uncontrolled pain (NRS >3). After the 30-minute block, there was a significant change in the mean NRS (0.4 ± 0.7 for rest, 1.9 ± 1.9 for movement, p < .001) compared to the previous assessment.

At the 24 hours after block, the FICB group demonstrated a lower percentage of uncontrolled pain compared to the control group (13.1% vs 91.7%, Figure 3). Moreover, it demonstrated significantly lower mean NRS at rest (0.5 vs 2.4, p < .001) and during movement (2.9 vs 5.6, p < .001) as shown in Table 2, accompanied by markedly reduced opioid consumption (0.1 vs 1.5, p < .001).

Table 2: Pain at rest and during movement

Outcome	Control group N = 24	FICB group N = 23	p-value
Pain on admission, mean ± SD			
NRS at rest	3.1 ± 1.5	4.1 ± 2.2	.075
NRS during movement	5.5 ± 1.6	7.4 ± 2.6	.004*
Opioid consumption (mg)	0.6 ± 1.4	0.4 ± 1.2	.7
Pain at 24 hours, mean ± SD			
NRS at rest	2.4 ± 1.3	0.5 ± 0.8	< .001*
NRS during movement	5.6 ± 1.5	2.9 ± 1.1	< .001*
Opioid consumption (mg)	1.5 ± 1.3	0.1 ± 0.2	< .001*

* Significant p < .01

NRS: numerical pain rating scale

Table 2: Pain at rest and during movement (continued)

Outcome	Control group N = 24	FICB group N = 23	p-value
Pain at 48 hours, mean ± SD			
NRS at rest	2.3 ± 1.6	0.8 ± 0.9	< .001*
NRS during movement	5.1 ± 1.7	3.1 ± 1.1	< .001*
Opioid consumption (mg)	1.2 ± 1.3	0.8 ± 1.3	.308

* Significant p < .01

NRS: numerical pain rating scale

The impact of the block persisted throughout the perioperative period. Among the ten participants operated within 24–48 hours, a comparison of NRS before the operation between the FICB and control group revealed a significantly lower scores at rest (1 vs 3, p = .007), along with lower percentage of uncontrolled pain (33% vs 100%) (Figure 3). However, no significant difference of NRS was observed during movement (4 vs 6, p = .03).

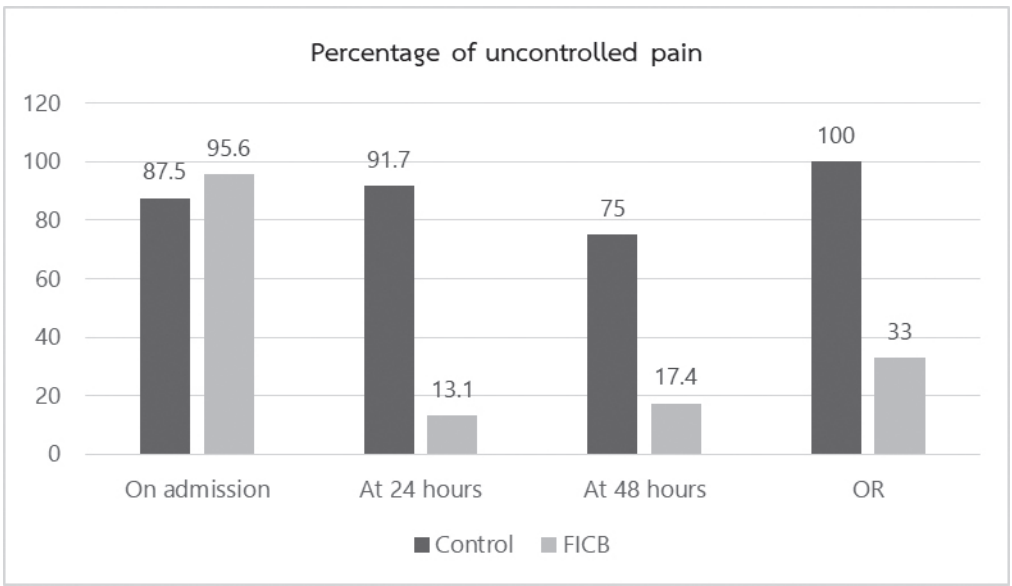

Figure 3: Percentage of uncontrolled pain

After 48 hours, the FICB group continued to exhibit a lower percentage of uncontrolled pain (17.4% vs 75%) and maintained significantly lower mean NRS at rest (0.8 vs 2.3, p < .001) and during movement (3.1 vs 5.1, p < .001), along with a higher percentage of ambulation on bed (82.6% vs 20.8%, p < .001). Although the incidence of delirium (16.7% vs 8.7%, p .413) and pneumonia (4.2% vs 0%, p .322) was lower in the FICB group, the differences were not statistically significant (Table 3). Similarly, opioid consumption at 48 hours and satisfactory scores did not show a significant difference between the groups.

Table 3: Secondary outcome

Secondary outcome	Control group N = 24, n (%)	FICB group N = 23, n (%)	p-value
Delirium	4 (16.7)	2 (8.7)	.413
Pneumonia	1 (4.2)	0 (0)	.322
Ambulation	5 (20.8)	19 (82.6)	< .001*
Satisfactory score**	7.3 ± 1	8.5 ± 2.2	.017

* Significant p < .01

** Satisfactory score: 0 = unsatisfied, 10 = maximal satisfied

Discussion

In this study, the fascia Iliaca block demonstrated benefits by reducing the numerical pain rating scale, lowering the incidence of uncontrolled pain, and decreasing opioid consumption before the operation. Furthermore, the significant effect of this block promoted ambulation in geriatric hip fracture patients.

The analgesic effect of this block arises from its coverage of the femoral nerve and lateral femoral cutaneous nerve of the thigh, producing anesthesia and analgesia in the anteromedial and anterolateral thigh which are the primary innervation sites of the hip joint. The duration and efficacy of the block depend on the concentration, type of local anesthetic agent, and the volume used[5].

In this study, a 0.33% bupivacaine solution with a volume of 30 ml was utilized. This differed from Hanna's 2014 study[9], which employed 0.25% bupivacaine ranging from 20–40 ml depending on patients' weight. Interestingly, Hanna's study did not show statistically significant differences in pain scores between the block group and control group at 24 hours. However, in the current study, an increase in concentration and volume demonstrated statistical significance at 24 and 48 hours.

The consumption of opioids was significantly lower at the 24-hour mark in the FICB group, although the difference in opioid consumption at 48 hours did not reach statistical significance. The impact of opioid consumption may be confounded by ten participants undergoing surgery between 24 and 48 hours, including four from the control group and six from the FICB group potentially receiving post-operative opioids, which could have influenced the observed outcomes.

The study indicated that uncontrolled pain leaded to immobilization, as evidenced by a significantly higher percentage of bed ambulation in participants who received FICB compared to the control group. This observation aligned with findings in Diakomi[8] 2014, which employed fascia iliaca for assisting in positioning for spinal block.

The occurrence of delirium appeared to be less frequent in the FICB group, as indicated by a prior study conducted by Mouzopoulos[10] in 2009. However, the association was not statistically significant, suggesting that fascia iliaca block may only prevent delirium in intermediate-risk patients. Within our study, four participants from the control group and two from the FICB group experienced delirium. Additionally, one participant from the control group and two from the FICB group had history of previous delirium, a known risk factor for delirium[11]. Despite these confounding variables, it was noteworthy that adequate pain control and reduced opioid consumption might serve as preventive measures. Therefore, our findings suggested a potential benefit of FICB in preventing delirium.

In this study; the lack of complications related to fascia iliaca block; such as hematoma, hypotension, or local anesthetic systemic toxicity (LAST); could be credited to the utilization of ultrasound guidance; which has proven effective in reducing potential adverse events[12].

A limitation of the study was evident as, despite the FICB group exhibiting lower opioid consumption compared to the control group (0.1 vs 1.5 mg), the mean NRS in the control group was higher. This incongruity could be associated with the administration of nurse-initiated analgesia with standard orders in this study. Future investigations could enhance accuracy by incorporating patient-controlled analgesia in participants with good cognitive function, offering more precise insights into opioid consumption. Additionally, excluding patients who underwent surgery would contribute to a more accurate interpretation of the study results, warranting further investigation.

Conclusion

The fascia iliaca compartment block exhibits preoperative analgesic effects, facilitates patient ambulation, and potentially reduces complications associated with uncontrolled pain in geriatric hip fractures.

Acknowledgement

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