Analgesic Efficacy of Ultrasound-guided Fascia Iliaca Compartment Block (FICB) and Outcomes in Preoperative Fast-track Geriatric Patients with Hip Fracture: A Single-center Retrospective Study

Chutima Leewatchararoongjaroen, M.D., Suwimon Tangwiwat, M.D.*, Piyawadee Rungmongkolsab, BNS, Pawadee Sutthaso, BNS

Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

ABSTRACT

Objective: This study aimed to evaluate the analgesic efficacy of preoperative fascia iliaca compartment block (FICB) in terms of preoperative pain score reduction in geriatric hip fracture patients. Secondary objectives were to compare opioid consumption, procedure-related complications, and patient outcomes.

Materials and Methods: This single-center retrospective study included patients aged 65 or older with hip fractures who experienced moderate to severe pain in a tertiary care university hospital from January 2019 to July 2021. The variables collected for analysis were patient baseline characteristics and the pain score at rest, including during movement from the beginning of service and subsequently each morning after admission until the day of surgery.

Results: A total of 439 patients were included in this study, 109 patients (24.8%) receiving preoperative FICB (FICB group). When comparing the FICB and non-FICB groups, a significant reduction in pain scores was observed on postadmission day 1, both at rest (0 [IQR=0-4] vs. 0 [IQR=0-2], p<0.001) and during movement (0 [IQR=0-4] vs. 0 [IQR=0-2], p=0.018). This difference in pain reduction persisted on day 2 during movement (3 [IQR=0-5.75] vs. 0 [IQR=0-3], p=0.001). No significant differences in preoperative opioid consumption or postoperative morbidities were observed between these two groups, and no complications related to the procedure were observed.

Conclusion: For patients experiencing moderate to severe preoperative pain at the beginning of treatment, preoperative FICB can reduce pain scores for up to 2 days.

Keywords: Fascia iliaca compartment block; geriatrics; hip fractures; regional anesthesia; analgesia; preoperative procedures (Siriraj Med J 2024; 76: 436-443)

INTRODUCTION

An increase in hip fracture patients around the world has become a concern for the morbidity and mortality of geriatric patients who often have multiple comorbidities.[1,2] Ensuring an adequate level of analgesia for these patients is important to improve outcomes and reduce complications, such as delirium[3-5], pressure ulcers, lung infections, urinary system infections[2,6,7], and decrease the length of hospital stays (LOS).[8]

During the preoperative period, standard multimodal analgesic management approaches the use of oral or intravenous (IV) paracetamol and systemic opiates. These modalities are recommended to alleviate pain severity[9] and improve in-bed ambulation.[2,10,11]

*Corresponding author: Suwimon Tangwiwat
E-mail: stangwiwat@yahoo.com
Received 18 January 2024 Revised 27 February 2024 Accepted 26 March 2024
ORCID ID:http://orcid.org/0000-0003-0191-3664
https://doi.org/10.33192/smj.v76i7.267376

One method used for pain relief in hip fractures is the fascia iliaca compartment block (FICB), which was first described by Sharrock in 1989.[12] FICB targeting the fascia iliaca compartment to administer a large volume of a low concentration local anesthetic effectively reduces pain by affecting the femoral and lateral cutaneous nerves of the thigh.[13]

Many studies on FICB have demonstrated its effectiveness in providing significant pain relief, both at rest and during movement, as well as in reducing the need for opioids in geriatric patients with hip fractures during the preoperative period or in the emergency department.[9,15]

Consequently, the benefits of a fast track for geriatric hip fractures extend beyond providing adequate pain management and optimizing patient conditions; it also advocates early surgery within 48 hours of admission.[15] Early surgical treatment is supported by evidence for improved outcomes, including a significant reduction in in-hospital mortality[4], 30-day mortality[7], delirium[2,3], and LOS.[8]

The primary objective of this study was to evaluate the efficacy of preoperative fascia iliaca compartment block (FICB) in reducing preoperative pain scores among patients with acute geriatric hip fracture within the fast-track program. Secondary objectives included a study of serious complications related to the procedure and the use of opioids, as well as a study of morbidities and mortality.

MATERIALS AND METHODS

Study design

The approval of this single-center single-center retrospective study was obtained from the Siriraj Institutional Review Board, Siriraj Hospital, Faculty of Medicine Mahidol University, Thailand (COA no. Si 163/2022). Patient information was collected from medical records stored in the REDCap (Research Electronic Data Capture) system of Siriraj Hospital's Acute Pain Management Unit. The data collection period spanned January 2019 to July 2021.

Setting

According to the protocols established by the Acute Pain Service (APS) for the treatment of fast track geriatric hip fracture at Siriraj Hospital, as shown in Fig 1, individuals who meet the criteria, specifically those aged 65 years or older with hip fractures that occurred in the last 7 days, are appropriately referred to the APS Unit.

Pain assessments were performed by APS physicians or nurses either in the emergency department or on the ward, depending on the time of consultation, depending on

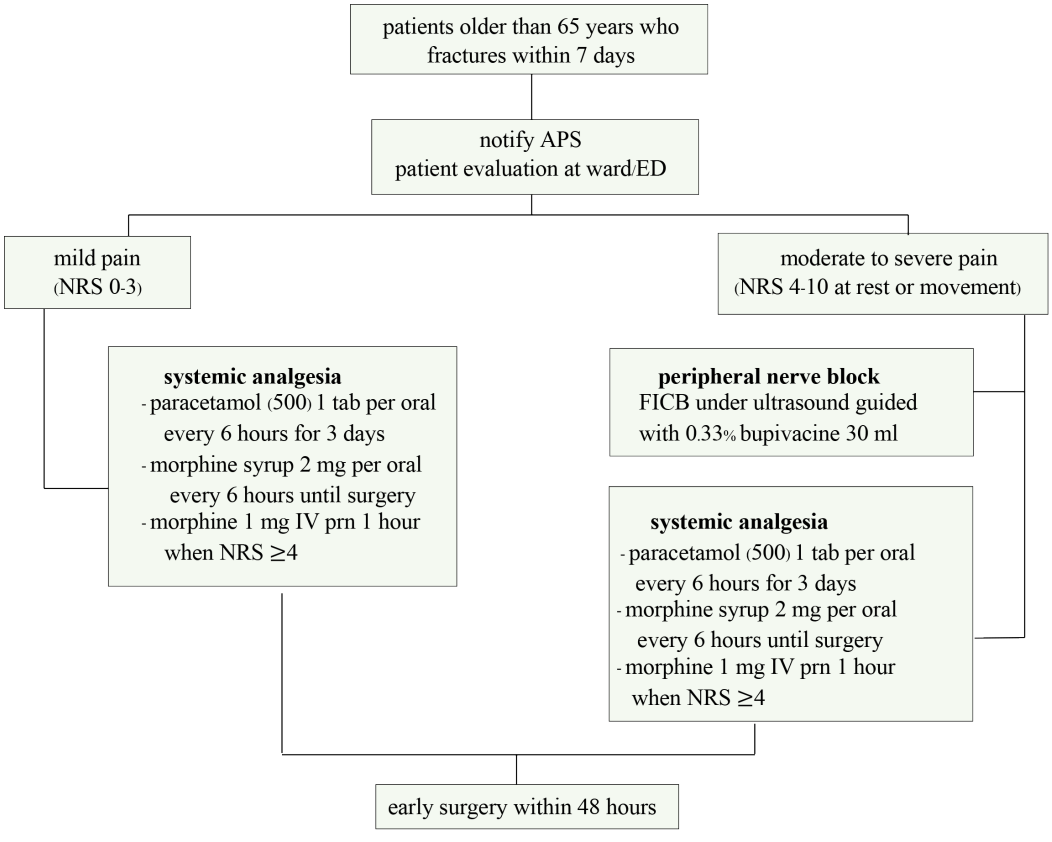

Fig 1. Pain Management Protocol for Fast Track Acute Geriatric Hip Fracture in Siriraj Hospital
Abbreviations: APS; Acute pain service, ED; Emergency Department, NRS; Numerical Rating Scale, FICB; Fascia iliaca compartment block, mg; milligrams, IV; intravenous

the consultation time. This scale categorizes the intensity of pain into mild, moderate, and severe descriptors. Pain assessments were conducted at the beginning of service and subsequently each morning following admission until the day of surgery.

Patients in the moderate to severe pain group, defined as an NRS score of 4-10 at rest or during movement, were encouraged to undergo preoperative FICB in the emergency room or on the ward within 24 hours after admission, combined with systemic analgesia that includes paracetamol 500 mg orally every 6 hours, morphine syrup 2 mg orally every 6 hours, and additional morphine 1 mg intravenously for breakthrough pain every 1 hour (when NRS increased beyond 3). Patients who had NRS scores of 0-3 were defined as having mild pain and received only systemic analgesia. Due to the presence of various comorbidities and geriatric age groups, caution was practiced with respect to the use of NSAIDs, especially in the preoperative period when volume status may be compromised.

The single shot ultrasound-guided fascia iliaca compartment block technique (FICB) was performed using 30 ml of 0.33% bupivacaine. Nerve block procedures were performed by a mixed team of staff anesthesiologists or residents under the supervision of staff anesthesiologists. Contraindications to FICB were patient refusal, INR >3, block site infection, and allergy to local anesthetics.[13]

Pain scores and evaluations of the procedure-related complications including local anesthetic systemic toxicity (LAST), block site hematoma or infection[15] were performed before block, 30 minutes after block, on the morning of each post-admission date, leading up to surgery in patients who received FICB.

Data collection

Between January 2019 and July 2021, the total number of 439 patients participating in the fast-track program were enrolled in this retrospective descriptive analysis. Subsequently, only patients experiencing moderate to severe pain, as indicated by the protocol, were included for the administration of fascia iliaca compartment block (FICB). Patients with incomplete score data or who were unable to accurately describe the severity of their pain due to cognitive dysfunction or delirium, as well as those who had associated injuries, such as fractures of the upper extremities, were excluded from the study (Fig 2). This cohort was divided into two groups: one that received preoperative FICB (109) and another that did not (330). Several factors associated with subjects without FICB at our center include after-hours periods, delays in COVID-19 pandemic treatment, pain alleviation after receiving sufficient systemic analgesia and not meeting block criteria.

The variables and outcome measures collected for

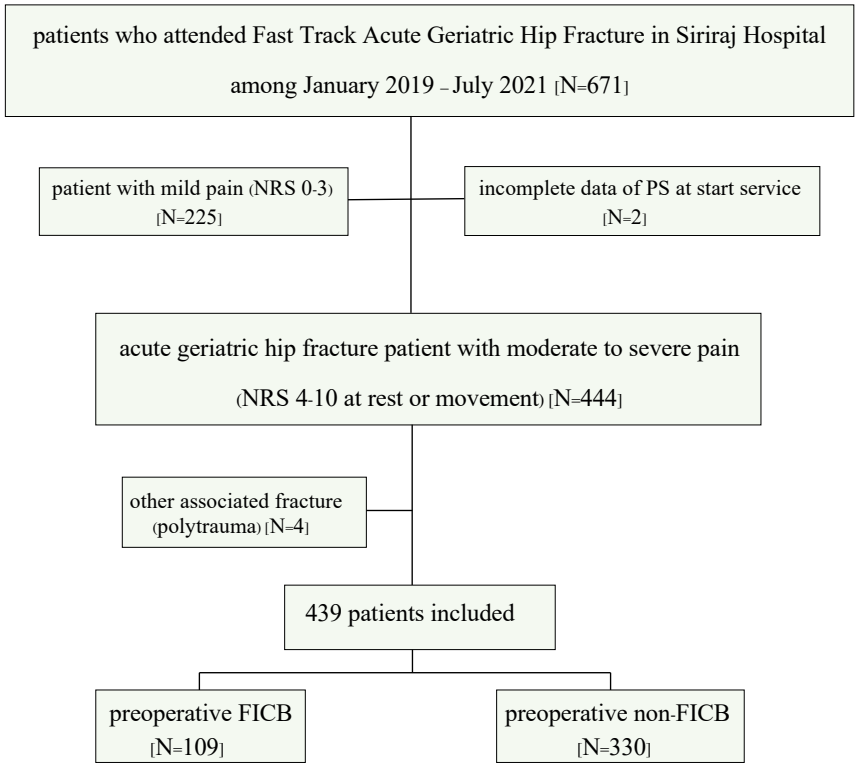

Fig 2. Study flow chart
Abbreviations: FICB; Fascia iliaca compartment block, PS; pain score

analysis were age, sex, BMI, ASA classification, fracture diagnosis, date and time of admission, surgical date and time, pain score at rest and during movement, recorded from the beginning of service and later each morning after admission until the day of surgery. We compared the variables in both groups; the FICB group and non-FICB

To evaluate pain scores, this study used the numerical rating scale (NRS) according to medical records, which assigns values from 0 to 10 to represent levels of pain severity.[16] The descriptive pain scores provided by the patients, including no pain, mild pain, moderate pain, and severe pain, were numerically interpreted by the mean values of VDS as 0, 2, 5, and 8, respectively.[17]

In the intervention group, the effectiveness of FICB was measured by recording the reduction in pain scores 30 minutes after blockade.

The decrease in the preoperative pain score refers to the values of the pain scores that decrease after receiving APS treatment. This analysis included pain scores evaluated at rest and during movement on post-admission days 1, 2, and 3 in relation to baseline pain scores recorded at the start of APS treatment for both groups. The efficacy of FICB in our study was measured by the pain score reduction in the intervention group.

Preoperative opioid consumption was collected and evaluated by comparing two groups, expressed in morphine milligram equivalents (MME). Oral morphine doses were converted to equivalent intravenous doses by dividing by three[18], and additional breakthrough intravenous morphine doses were administered on request. The cumulative MME was then documented for each preoperative day up to the day of surgery.

Postoperative data, which included variables including length of hospital stay (LOS) and morbidities, which were acute myocardial infarction, pneumonia, urinary tract infection, pressure ulcer, acute kidney injury, and in-hospital death, were collected and compared between the two groups.

Sample size calculation

After conducting a sample size calculation based on the reduction in pain scores after FICB administration, with a mean difference of 1.05[2], a standard deviation of 2.0, a significance level of 0.05, and a power of 90%, accounting for a 20% dropout rate, the final sample size determined was at least 100 subjects per group.

Statistical analysis

Statistical analysis was performed using SPSS Statistics version 18 (SPSS Inc., Chicago, IL, USA). Demographic variables were presented as means and standard deviations (SD) for normally distributed continuous variables and frequency and percentage for categorical variables. Therefore, Student's t-test and Pearson's chi-square were used to compare the results between the two groups.

The comparison variables were present as a median with interquartile range (IQR) and computed using the nonparametric Mann-Whitney U test, as these outcomes did not follow a normal distribution. Pain scores before and after block were analyzed using the Wilcoxon signed rank test. A P-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 439 patients who encountered moderate to severe pain along with the APS fast track protocol were included in this study. Among these, 109 patients received FICB and the remaining 330 patients did not receive FICB, a circumstance attributed to limitations at our center, which will be elaborated upon in the discussion section.

The mean age was 81.40 (SD=7.18) years, and 76.5% were women. For the preoperative FICB group, 83.5% consisted of women, which was significantly higher than in the non-FICB group. Within the FICB group, the mean age was 81.89 (SD=6.74) years. No significant differences were observed between the FICB and non-FICB groups regarding age, ASA physical status classification, BMI, and types of fracture (Table 1).

In this retrospective analysis, preoperative pain scores at the beginning of the service, both at rest and during movement, were significantly higher in the FICB group compared to the non-FICB group ($p<0.001$). As shown in Table 2, there were significantly higher pain scores in the FICB group than in the non-FICB group at rest and during movement at the start of the service ($p<0.001$). No significant differences were observed in post-admission pain scores on days 1, 2, and 3 in both groups.

Additionally, we analyzed pain score reduction as the primary outcome based on scores before APS management in both FICB and non-FICB groups (Table 2). The reduction in pain scores was found to be significant on day 1 after admission, both at rest 0 [IQR; 0, 4] in FICB vs 0 [IQR; 0, 2] in non-FICB ($p<0.001$) and during movement 0 [IQR=0, 4] in FICB vs 0 [IQR=0, 2] in non-FICB ($p=0.018$). The pain difference also remained significant on day 2 after admission for only during movement, with 3 [IQR; 0, 5.75] in FICB vs 0 [IQR; 0, 3] ($p=0.001$) in the non-FICB group.

The analysis illustrated the statistically significant

TABLE 1. Patient characteristics and pain-related data in the intervention and control groups.

	FICB Preoperative (N=109)	Non-FICB Preoperative (N=330)	P-value
Sex			0.048 *
Male (N, (%))	18 (16.5%)	85 (25.8%)	
Female (N, (%))	91 (83.5%)	245 (74.2%)	
Age (mean ± SD)	81.89 ± 6.74	81.23 ± 7.23	0.404
ASA classification (N, (%))			0.475
I	2 (1.8%)	6 (1.8%)	
II	35 (32.1%)	130 (39.4%)	
III	71 (65.1%)	188 (57.0%)	
IV	1 (0.9%)	6 (1.8%)	
BMI (mean ± SD)	22.78 ± 4.25	22.63 ± 4.12	0.745
Type of fracture (N, (%))			0.451
Neck of femur	47 (43.1%)	156 (47.3%)	
Intertrochanteric	56 (51.4%)	167 (50.6)	
Subtrochanteric	6 (5.5%)	7 (2.1%)	

Abbreviations: ASA; American Society of Anesthesiologists, BMI; body mass index, N; number, SD; standard deviation

effects of the post-FICB pain score at 30 minutes. The analysis showed that the pain score at rest decreased significantly from 5 [IQR; 2,8] to 0 [IQR; 0, 2] ($p<0.001$) and the pain score during movement also reduced significantly from 8 [IQR=7,10] to 2 [IQR=1,3] ($p<0.001$) from the beginning of the service and there were no serious complications such as LAST, hematoma and infection at the injection site.

The consumption of morphine and the postoperative data between the two groups were also compared, as shown in Table 3, the results did not reveal significant differences in milligram equivalents of morphine (MME) on days 1, 2, and 3 after admission among groups and there were no significant differences between the groups in length of hospital stay and postoperative complications, including acute myocardial infarction, pneumonia, urinary tract infection, pressure ulcer, acute kidney injury, and in-hospital death.

The surgical and anesthetic profiles of both groups indicate that 98.4% of all patients underwent hip surgery, with 83.8% undergoing surgery within 48 hours. The median time from admission to surgery was 37.7 hours [IQR; 20.8, 44.4]. Furthermore, the most common intraoperative technique was spinal block (75.7%), and intraoperative peripheral nerve block (PNB) was administered in 85.8% of the cases, with FICB being the predominant technique (97%).

DISCUSSION

Our study demonstrated that preoperative FICB effectively decreased pain scores in moderate to severe pain from geriatric hip fractures by decreasing immediately after nerve block, both at rest and during movement after admission day 1 and during movement after admission day 2. There were no differences in postoperative complications and length of hospital stay between the two groups. Minimizing pain in geriatric orthopedic trauma is known to improve patient outcomes. Several studies have demonstrated the benefits and effectiveness of FICB in terms of reducing pain scores and opioid requirements, primarily focusing on postoperative pain scores and outcomes.[2,11]

Our study found that NRS in the FICB group was initially significantly higher than in the non-FICB group, both during rest and during movement. However, after following the APS protocol, the NRS scores of the FICB group decreased to the same levels as non-FICB. This highlighted that our pain management was efficient for moderate to severe pain hip fracture.

TABLE 2. Preoperative pain score data and pain score reduction.

Pain score	FICB preoperative (N=109)	Non-FICB preoperative (N=330)	P-value
Before APS management			
At start service			< 0.001 *
rest (median [P_{25}, P_{75}])	5 [1.5,8]	2 [0,4]	
(N)	(109)	(330)	
movement (median [P_{25}, P_{75}])	8 [7,10]	6 [5,8]	
(N)	(101)	(319)	< 0.001 *
After APS management			
Postadmission day 1			
rest (median [P_{25}, P_{75}])	2 [0,4]	0 [0,2]	0.097
(N)	(100)	(271)	
movement (median [P_{25}, P_{75}])	6 [4,8]	5 [4,8]	0.104
(N)	(98)	(263)	
Difference from the starting point			
rest (median [P_{25}, P_{75}])	0 [0,4]	0 [0,2]	< 0.001 *
(n)	(100)	(271)	
movement (median [P_{25}, P_{75}])	0 [0,4]	0 [0,2]	0.018 *
(n)	(93)	(258)	
Postadmission day 2			
rest (median [P_{25}, P_{75}])	0 [0,3]	0 [0,2]	0.346
(N)	(57)	(125)	
movement (median [P_{25}, P_{75}])	4 [3,7]	5 [4,7]	0.193
(N)	(53)	(123)	
Difference from the starting point			
rest (median [P_{25}, P_{75}])	1 [1,5]	0 [0,3]	0.097
(N)	(57)	(125)	
movement (median [P_{25}, P_{75}])	3 [0,5.75]	0 [0,3]	0.001 *
(N)	(52)	(122)	
Postadmission day 3			
rest (median [P_{25}, P_{75}])	0 [0,3]	0 [0,2]	0.138
(N)	(17)	(25)	
movement (median [P_{25}, P_{75}])	5 [3,6.5]	5 [4,6]	0.967
(N)	(17)	(23)	
Difference from the starting point			
rest (median [P_{25}, P_{75}])	2 [0,5.5]	1 [0,3]	0.405
(N)	(17)	(25)	
movement (median [P_{25}, P_{75}])	2 [0,5]	1 [0,2]	0.114
(N)	(16)	(23)	

Abbreviations: APS; acute pain service, N; number, P_{25}; 25th percentile, P_{75}; 75th percentile

TABLE 3. Preoperative opioid consumption and postoperative outcome.

	FICB preoperative (N=109)	Non-FICB preoperative (N=330)	P-value
Preoperative opioid consumption (MME)			
Postadmission day 1 (median [P_{25}, P_{75}])	2.66 [2.66, 3.66]	2.66 [2.66, 3.60]	0.124
(N)	(102)	(271)	
Postadmission day 2 (median [P_{25}, P_{75}])	2.66 [2.66, 3.66]	2.66 [2.66, 3.66]	0.236
(N)	(58)	(125)	
Postadmission day 3 (median [P_{25}, P_{75}])	3.16 [2.66, 4.66]	2.66 [2.66, 3.66]	0.328
(N)	(18)	(24)	
Postoperative data			
Length of hospital stay (median [P_{25}, P_{75}])	10 [7,13]	10 [8,15]	0.061
Postoperative complications			
Acute myocardial infarction (N, (%))	3 (2.75%)	2 (0.6%)	0.067
Pneumonia (N, (%))	10 (9.2%)	21 (6.4%)	0.321
Urinary tract infection (N, (%))	16 (14.7%)	74 (22.4%)	0.082
Pressure ulcer (N, (%))	1 (0.9%)	5 (1.5%)	1
Acute kidney injury (N, (%))	5 (4.6%)	18 (5.5%)	0.725
In-hospital death (N, (%))	7 (6.4%)	25 (7.6%)	0.688

Abbreviation: MME; Morphine milligram equivalent

The results of this study align with previous research in the emergency department showing that FICB can significantly alleviate pain both at rest and during movement immediately after the 30-minute block.[9,15] In this study, FICB effectively reduced pain at rest and during movement, with reductions in reductions in NRS of 5 and 6, respectively, on a scale of 1 to 10 observed 30 minutes after block. The analgesic duration of FICB appears to be effective in reducing pain scores for two days post-admission in patients with moderate to severe pain.

Similar to other studies[2,13], we did not observe any serious complications, including local anesthetic systemic toxicity (LAST), injection site infection, or hematoma.

Schulte et al. demonstrated that FICB patients required fewer milligram equivalents of morphine before surgery.[11] However, there is a distinction in our inclusion criteria as we specifically enrolled patients experiencing moderate to severe pain. Additionally, our APS protocol allowed for additional intravenous morphine administration based on the patient's pain score and the nurse's assessment on the ward. There were no significant differences in morphine milligram equivalent (MME) between the FICB and non-FICB groups. The similarity in opioid consumption in both groups suggests that patients received only oral morphine consistently around the clock in adherence to the APS protocol. The absence of a difference in the additional intravenous morphine can be due to various factors, including the absence of additional pain, the patient's reluctance to request or the nurse's reluctance to administer intravenous morphine.

According to the fast-track geriatric hip fracture management plan, patients who receive adequate pain control and are optimized for surgery in less than 48 hours experience improved outcomes[19], including significantly reduced in-hospital mortality[6], lower 30-day mortality[7] and decreased length of hospital stay.[8] In our study, the majority of patients underwent surgery (98.4%), with 83.8% of all fractured patients undergoing the procedure within 48 hours, which was in both groups. Consequently, there were no statistically significant differences in postoperative outcomes, including various systemic complications, length of hospital stay, and in-hospital mortality.

Limitations of the study, this study was a retrospective descriptive study that had several limitations, including

insufficient data and the potential for data loss. Pain assessments were limited by once daily, timing, and insufficient evaluation of uncommunicative geriatric patients. The absence of significant differences in opioid consumption can be associated with factors that involve both patients and nurses, limiting opioid use due to concerns about respiratory depression on the admission ward. Furthermore, procedure-related complications were rare events, so our sample size may have been inadequate to establish these complications.

In conclusion, FICB demonstrates efficacy in reducing preoperative pain scores for up to 2 days among geriatric hip fracture patients experiencing moderate to severe pain, without procedure-related complications. Consequently, FICB significantly impacts pain management strategies, particularly in terms of minimizing preoperative pain scores when combined with multimodal analgesia, which includes paracetamol and low-dose oral opioids.

Future research on FICB and fast-track hip fracture management will be conducted through prospective studies that will control all limitations mentioned in this study, including protocol compliance and procedure time point.

ACKNOWLEDGMENTS

The authors thank Ms. Julaporn Pooliam, M.Sc. for statistical support and our research team members including Prof. Manee Raksakietisak, Assist. Prof. Suratsawadee Wangnamthip and Ms. Arporn Pimtong for administrative support.

Funding

This research project was funded by the Faculty of Medicine Siriraj Hospital, Mahidol University, Grant Number (IO) R016632003.

Conflicts of interest

The authors of this work have nothing to disclose.

REFERENCES

1. Dixon J, Ashton F, Baker P, Charlton K, Bates C, Eardley W. Assessment and Early Management of Pain in Hip Fractures: The Impact of Paracetamol. Geriatr Orthop Surg Rehabil. 2018;9:1-6.
2. Guay J, Kopp S. Peripheral nerve blocks for hip fractures in adults. Cochrane Database Syst Rev. 2020;11(11):CD001159.
3. Pioli G, Bendini C, Giusti A, Pignedoli P, Cappa M, Iotti E, et al. Surgical delay is a risk factor of delirium in hip fracture patients with mild-moderate cognitive impairment. Aging Clin Exp Res. 2019;31(1):41-7.
4. Sayers A, Whitehouse M, Berstock J, Harding K, Kelly M, Chesser T. The association between the day of the week of milestones in the care pathway of patients with hip fracture and 30-day mortality: Findings from a prospective national registry - The National Hip Fracture Database of England and Wales. BMC Med. 2017;15(1):62.
5. Suenghataiphorn T, Songwisit S, Tornsatitkul S, Somnuke P. An Overview on Postoperative Cognitive Dysfunction; Pathophysiology, Risk Factors, Prevention and Treatment. Siriraj Med J. 2022; 74(10):705-13.
6. Rozenfeld M, Bodas M, Shani M, Radomislensky I, Murad H, Comaneshter D, et al. National study: Most elderly patients benefit from earlier hip fracture surgery despite co-morbidity. Injury. 2021;52(4):905-9.
7. Pincus D, Ravi B, Wasserstein D, Huang A, Paterson JM, Nathens AB, et al. Association Between Wait Time and 30-Day Mortality in Adults Undergoing Hip Fracture Surgery. JAMA. 2017;318(20): 1994-2003.
8. Yang Z, Ni J, Long Z, Kuang L, Gao Y, Tao S. Is hip fracture surgery safe for patients on antiplatelet drugs and is it necessary to delay surgery? A systematic review and meta-analysis. J Orthop Surg Res. 2020;15(1):105.
9. Pinson S. Fascia Iliaca (FICB) block in the emergency department for adults with neck of femur fractures: A review of the literature. Int Emerg Nurs. 2015;23(4):323-8.
10. Garlich JM, Pujari A, Moak Z, Debbi E, Yalamanchili R, Stephenson S, Stephen S, et al. Pain Management with Early Regional Anesthesia in Geriatric Hip Fracture Patients. J Am Geriatr Soc 2020;68(9):2043-50.
11. Schulte SS, Fernandez I, Van Tienderen R, Reich MS, Adler A, Nguyen MP. Impact of the Fascia Iliaca Block on Pain, Opioid Consumption, and Ambulation for Patients With Hip Fractures: A Prospective, Randomized Study. J Orthop Trauma 2020; 34(10):533-8.
12. Sharrock NE. Inadvertent "3-in-1 block" following injection of the lateral cutaneous nerve of the thigh. Anesth Analg. 1980; 59(11):887-8.
13. O'Reilly N, Desmet M, Kearns R. Fascia iliaca compartment block. BJA Educ: Elsevier BV; 2019. p. 191-7.
14. Makkar JK, Singh NP, Bhatia N, Samra T, Singh PM. Fascia iliaca block for hip fractures in the emergency department: meta-analysis with trial sequential analysis. Am J Emerg Med. 2021; 50:654-60.
15. Jiang M, Liu S, Deng H, Liang X, Bo Z. The efficacy and safety of fast track surgery (FTS) in patients after hip fracture surgery: a meta-analysis. J Orthop Surg Res. 2021;16(1):1-24.
16. Haefeli M, Elfering A. Pain assessment. Eur Spine J. 2006;15 Suppl 1(Suppl 1):S17-24.
17. Jones KR, Vojir CP, Hutt E, Fink R. Determining mild, moderate, and severe pain equivalency across pain-intensity tools in nursing home residents. J Rehabil Res Dev. 2007;44(2):305-14.
18. Tan S, Lee E, Lee S, Sakaria SS, Roh JS. Morphine Equianalgesic Dose Chart in the Emergency Department. J Educ Teach Emerg Med. 2022;7(3):L1-L20.
19. Roberts KC, Brox WT. AAOS Clinical Practice Guideline: Management of Hip Fractures in the Elderly. J Am Acad Orthop Surg. 2015;23(2):138-40.