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ORIGINAL RESEARCH

Enhancing Emergency Department Pain Management for Older Adults with the Hip Fracture Fast-Track (HFFT) Protocol in a Middle-Income Country

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Purpose: This study aimed to evaluate the impact of the Hip Fracture Fast-Track (HFFT) protocol, designed specifically for older patients at our hospital, which commenced on January 1, 2022, on the management of emergency department (ED) pain in older adults with hip fractures.

Patients and Methods: Retrospective pre- and post-study data from electronic health records (EHR) at our hospital, using the International Classification of Diseases (ICD)-10 codes S72.0, S72.1, S72.8, and S72.9, were utilized. The study included patients aged 65 years or older who presented to the ED with low-energy, non-pathologic isolated hip fractures or proximal femur fractures. The pre-HFFT period included patients from January 1, 2020, to December 31, 2021, and the post-HFFT period included patients from January 1, 2022, to October 31, 2023. Data were compared for the proportion of patients undergoing pain evaluation in the ED, before discharge, time to first analgesia, number of patients receiving pain relief in the ED, and the use of fascia iliaca compartment blocks (FICBs) and pericapsular nerve group blocks (PENGBs).

Results: The final analysis involved 258 patients, with 116 in the pre-protocol group and 142 in the post-protocol group. The rate of analgesic use increased significantly in the post-HFFT group (78 [67.24%] vs 111 [78.17%], P = 0.049). The rate of pain score screening at triage increased from 51.72% before the HFFT protocol to 86.62% post-HFFT protocol ($p < 0.001$). Compared with the pre-HFFT protocol, the post-HFFT protocol exhibited a higher rate of FICB (0% vs 14.08%, $p < 0.001$) and PENGB (0% vs 5.63%, $p = 0.009$) administration.

Conclusion: The HFFT protocol's implementation was associated with improved ED pain evaluation and analgesic administration in older adults with hip fractures. These findings indicate that tailored protocols, such as the HFFT, hold promise for enhancing emergency care for this vulnerable population.

Keywords: older adult, hip fracture fast-track protocol, middle-income country

Introduction

Hip fractures, a common injury among older adults, are associated with elevated rates of morbidity and mortality, as well as increased healthcare costs, particularly among women.[1] Hip fractures are estimated to affect approximately 18% of women and 6% of the global population,[1] and a significant contributing factor to their severity is the associated pain, which not only leads to severe consequences but also delayed recovery. According to a study conducted in 36 Australian hospitals, analgesia was not documented in 28.6% of older adults with fractures, and the median delay between a patient's arrival at the emergency department (ED) and the administration of analgesia was 75 minutes.[2] This delay is attributed to the decline in the ability to

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perceive and communicate as individuals age, along with physical limitations and underlying illnesses. Consequently, pain assessment and management may be inadequate, negatively affecting the physical and mental well-being of patients and causing anxiety for their relatives as well.[3–5] Due to the aforementioned factors, numerous medical institutions have conducted studies or developed more efficient pain management guidelines in the ED.[6–8] Casey SD et al conducted a study on the effects of implementing a multidisciplinary geriatric fracture program (GFP). Following the program, the rate of fascia iliac compartment blocks (FICBs) increased from 6% to 60%. The time to first analgesia was shortened from 103 minutes prior to the program to 93 minutes post-GFP treatment.[6] Additionally, Fosnocht et al employed the triage pain methodology, revealing a notable increase in the percentage of patients receiving analgesic drugs, rising from 45% to 69%. Simultaneously, the average duration for patients to receive these medications decreased from 76 minutes to 40 minutes.[7] An alternative strategy to improve pain management involves educating emergency medicine nurses on triaging patients and implementing pain management protocols for orthopedic injuries. Notably, Sepahvand et al found that teaching these techniques to emergency medicine nurses led to a reduction in patient pain. The average time for patients to receive medication decreased from 64 minutes to 22 minutes, resulting in significant improvements in patients' pain levels after receiving pain relievers.[8] Numerous studies have demonstrated the effectiveness of the hip fracture fast track (HFFT) program in reducing hospital expenses,[9] as well as decreasing morbidity[10–12] and mortality rates.[12] Key components of the HFFT program include early mobilization, prompt surgical fixation, timely pain management, and delirium prevention. There was a dearth of data evaluating ED pain management for older adults[6] with hip fractures in countries with limited resources, as many of the HFFT programs[10–12] were examined after in-hospital admission.

Thailand, a middle-income country, has been experiencing an aging population trend since 2021.[13] In response to this demographic shift, Our hospital has implemented an HFFT program for older persons that focuses on ED pain management and ED length of stayed using the uplevel triage and time to operate within 72 hours after admission for older adult who suspected of hip fracture. Our main objective was to investigate the impact of the HFFT program on pain management for older adults with hip fractures in the ED. The designed HFFT protocol,[14–18] as hypothesized by the researcher, is anticipated to enhance pain assessments, decrease the time of initial analgesic administrations, and increase the use of regional anesthetics in the ED.

Materials and Methods

Study Design

This investigation utilized retrospective pre- and post-study data from our hospital's electronic health record system (EHR). This study was approved by the institutional review board of Vajira hospital. The need for patient consent was waived. Patients' records were coded in numbers, making it impossible to identify them individually. The data were stored in an encrypted program.

Study Setting and Population

This study was conducted at a single metropolitan teaching hospital in central Thailand, where approximately 45,000 ED visits occur annually. In 2021, our hospital witnessed approximately 1500 visits related to low-energy trauma (falls) among older persons, with 10% involving hip fractures. To improve patient care, an HFFT protocol for older adults was introduced on January 1, 2022. Collaboratively developed by the Departments of Orthopedics, Anesthesia, Internal Medicine, Rehabilitation Medicine, Home Health Care Services, Pharmacy, and Emergency Medicine, the HFFT protocol encompassed early ED pain management, surgical fixation within 72 h, prevention of deep vein thrombosis and delirium, early mobilization and physical therapy, early discharge planning, and follow-up home visits. Monthly HFFT team meetings were conducted to address patient and system issues. Within the ED, the HFFT included pain control, consisting of up-level triage to emergency severity index (ESI) level 2 unless patients met ESI level 1 criteria. Verbal-numeric rating scales were used to assess pain in older adults with normal cognitive function, while the Pain Assessment in Advanced Dementia (PAINAD)[18] scale was used to assess patients with cognitive impairment. A pain management protocol was implemented, including ketamine, opioid drugs, and FICBs[19–21] or pericapsular nerve group blocks (PENGBs)[22–24] for regional anesthesia (Figure 1). For emergency medicine residents in training, we held a three-hour combined lecture and workshop on hip fracture pain management. Topics covered included the

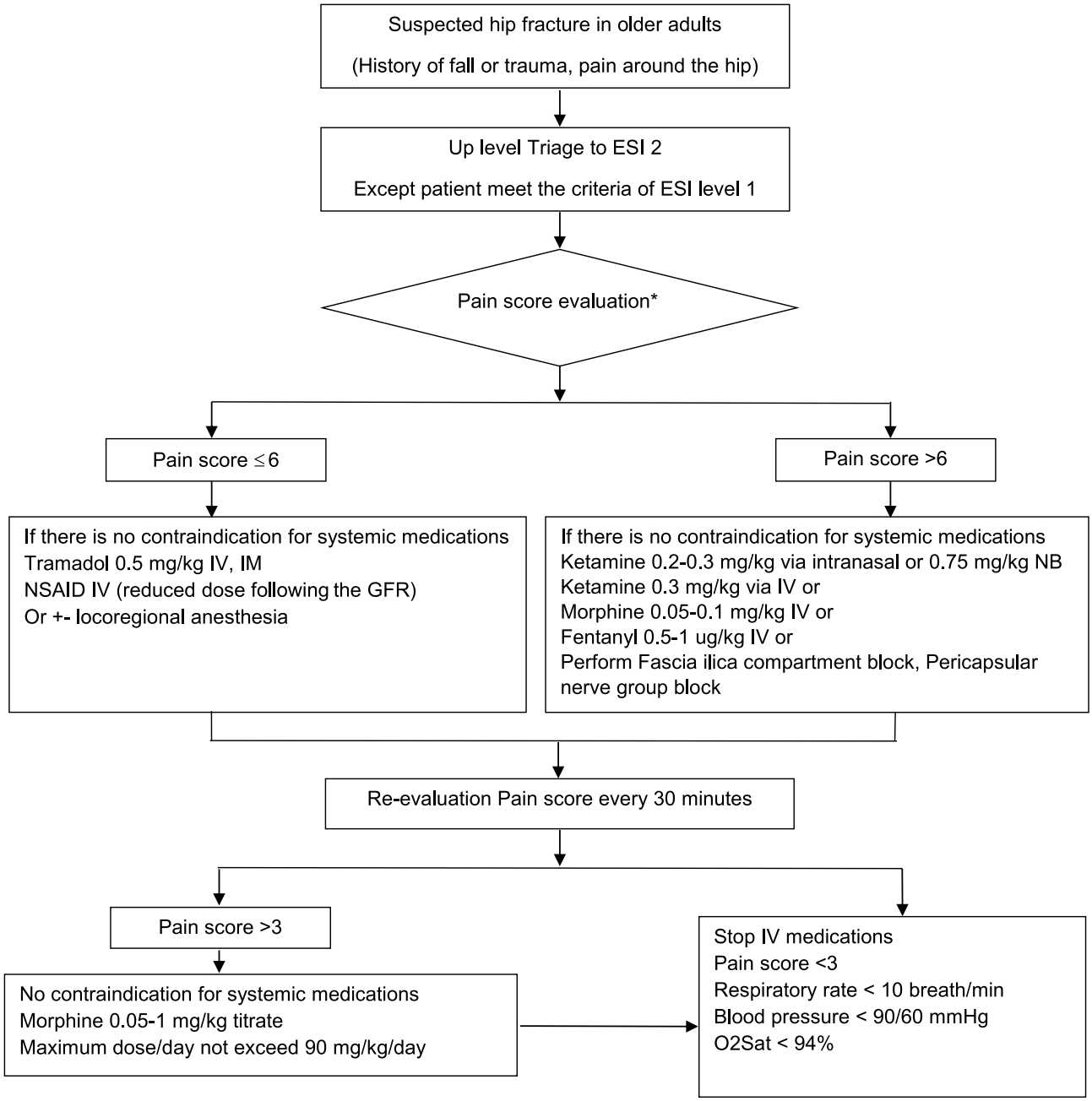

Figure 1 Protocol for pain management in ED of older adults with Hip fractures. Vajira Hip Fracture pain management protocol.
Notes: *Pain score evaluation; Cognitively intact: use numeric rating scale, Wong–Baker Face Pain scale, Cognitive impairment: PAINAD or Abbey Pain Scale.

HFFT pain protocol, pain assessment in older adults with normal cognitive function and cognitive impairment, analgesic medication and its administration route, as well as practice for the subcutaneous, intravenous, and intranasal routes of administration. Additionally, we spent one hour on ultrasound guide FICBs and PENGBs.

Two hours were dedicated to a lecture and workshop for emergency nurses, covering topics such as the HFFT pain protocol, pain assessment in older adults with both normal and cognitive impairment, analgesic medication and its administration route, and practicing the intranasal, subcutaneous, and intravenous routes of administration.

Most PENGBs and FICBs were performed by two emergency physicians (EPs). Indications for regional anesthesia included severe pain, discomfort, or pain that did not improve after one or more opioid doses, as well as the availability of EPs. The pre-HFFT period included patients from January 1, 2020, to December 31, 2021, and the post-HFFT period included patients from January 1, 2022, to October 31, 2023.

This study included patients aged 65 years or older who presented to the ED with low-energy, non-pathologic isolated hip fractures or proximal femur fractures (including subcapital, intertrochanteric, femur-neck, and subtrochanteric locations). Patients were excluded if they had high-energy injury mechanisms such as falls from heights greater than five feet or motorbike crashes, periprosthetic fractures, multiple injuries, cardiac arrest, needing rapid interventions, requiring transfer to another hospital or transfer from another hospital.

Study Protocol

All patients were identified using the International Classification of Diseases (ICD)-10 codes S72.0, S72.1, S72.8, and S72.9. The principal investigator verified that the patient's hospital number was known and had an ICD-10 code. Next, the research assistant (RA) was provided with the hospital number without informing them of the patients' group. A trained research assistant with a bachelor's degree in public health and two years of experience conducting research on acute pain management in older adults manually reviewed each chart to determine whether inclusion and exclusion criteria were met. The reviewer was not blind to the patient's hospital number; rather, they were blind to the study hypothesis. The following data were extracted from the EHR: sex, age, fracture site, Charlson Comorbidity Index, time to first analgesia, type of analgesic drug, type of regional anesthesia used, adverse events following the use of a regional anesthetic and analgesic drug, pain score evaluation following the use of a regional anesthetic, time to imaging, time to surgery, length of stay in the ED, delirium within 48 h, and admission services.

Measures

Primary outcomes were the proportion of patients who underwent pain evaluation in the ED and before ED discharge, time to first analgesia, number of patients receiving pain relief in the ED, use of FICBs or PENGBs in the ED, and whether patients experienced any side effects or delirium within 48 h after medication administration.

The time between ED triage and initial analgesic administration was defined as "time to first analgesia". Any documented pain score at triage was considered the ED triage pain score. Any documented pain score at ED disposition was defined as the ED disposition pain score. The time from ED disposition to surgery was defined as "time to operation".

Data Analysis

Sample Size

According to a study by Fosnocht et al,[7] 69% of patients at the ED received medication for older persons after the practice guidelines were implemented, compared to 45% of patients who did so before. These data were used to calculate the sample size. Two groups receiving medication were compared using a formula for binary outcomes and a 1:1 ratio for each group. As a result, 90% of the sample size's power was used in this investigation. The size of each group was 115.

Statistical Analysis

For continuous data, we used the *t*-test for normal distribution and the Wilcoxon signed-rank test for non-normal distribution. For categorical data, we used the chi-squared test or Fisher's exact test, as appropriate. The survival analysis was used to evaluate the waiting time from triage to first analgesia. All tests were calculated by using STATA software version 13 and considered statistically significant when p-values were less than 0.05.

Results

Hip fractures, including subcapital, intertrochanteric, cervical, and subtrochanteric femoral fractures, were diagnosed in 331 patients. Our analysis resulted in the exclusion of 73 patients, of whom 44 were transferred from other hospitals, 12 received pain medication prior to ED admission, seven had serious trauma, five had periprosthetic fractures, two required immediate intervention, two had no ED records, and one left against medical advice (Supplement 1). A total of 258 patients—116 in the pre-protocol group and 142 in the post-protocol group—were included in the final analysis. The majority of patients in both groups were women (85 [73.28%] in pre-HFFT vs 110 [77.46%] in post-HFFT). The median patient age was 80 years. The baseline characteristics of the patients are shown in Table 1.

The rate of analgesic use significantly increased in the post-HFFT group (78 [67.24%] vs 111 [78.17%], P = 0.049). In the post-HFFT group, there was a shorter period from ED admission to the operation (86 [Interquartile range {IQR} 42–149.5] hours pre-HFFT vs 50 [IQR 35.5–69] hours post-HFFT, p < 0.001). The rate of pain score evaluation at triage increased from 51.72% pre-HFFT to 86.62% post-HFFT (p < 0.001), and the rate of pain score evaluation at ED disposition increased (14 [12.07%] pre-HFFT vs 80 [56.34%] post-HFFT, p < 0.001) (Table 2). The median waiting time from triage to first analgesia decreased by 27 min in the post-HFFT group (median 126 [74–361] min vs 99 [56–192] min, p < 0.01) (Figure 2).

Tramadol was the most frequently administered analgesic pre- and post-HFFT. However, the rate of tramadol administration decreased post-HFFT (39.66% vs 27.46%, p < 0.038). Compared to the pre-HFFT protocol, the post-HFFT protocol demonstrated increased rates of FICB (0% vs 14.08%, p < 0.001) and PENGB (0% vs 5.63%, p = 0.009) administration. Patients who received FICBs and PENGBs did not experience any recorded incidence of systemic toxicity from local anesthetics or any other complications (Table 3). During the post-HFFT period, 114 patients did not receive regional anesthesia. Forty-one patients had contraindications for the

Table 1 Patient Characteristics Pre-HFFT and Post-HFFT Established of a Hip Fracture Fast Track Protocol

	Pre-HFFT N=116 (100%)		Post-HFFT N=142 (100%)		P-value
Age (year), median (IQR)	80	75–86	80	73–86	0.882
Female sex, n (%)	85	73.28%	110	77.46%	0.436
Charlson co-morbidity index, mean (SD)		4.66 (1.49)		4.74 (1.43)	0.618
Underlying diseases, n (%)					
Diabetes Mellitus	39	33.62%	77	39.44%	0.335
Hypertension	75	64.66%	101	71.13%	0.267
Chronic kidney disease	25	21.55%	23	16.20%	0.272
Dyslipidemia	36	31.03%	58	40.85%	0.103
Cerebrovascular diseases	8	6.90%	17	11.97%	0.170
Causes of fall, n (%)					0.687
Slip or trip	68	58.62%	82	57.75%	
Fall from high < 5 feet	19	16.38%	19	13.38%	
Others	29	25.00%	41	28.87%	
Primary diagnosis, n (%)					0.273
Fracture of neck of femur	63	54.31%	77	54.23%	
Intertrochanteric fracture	49	42.24%	64	45.07%	
Peritrochanteric fracture	4	3.45%	1	0.720%	
Mode of arrival, n (%)					0.383
Ambulance	52	44.83%	56	39.44%	
Private car	64	55.17%	86	60.56%	
Time of arrival, n (%)					0.081
00.01–8.00	21	18.10%	13	9.15%	
8.01–16.00	60	51.72%	75	52.82%	
16.01–00.00	35	30.17%	54	38.03%	

Abbreviations: HFFT, Hip Fracture Fast-Track protocol; IQR, interquartile range; SD, standard deviation.

Table 2 Time Interval and ED Pain Management Pre-HFFT and Post-HFFT Established of a Hip Fracture Fast Track Protocol in the ED

	Pre-HFFT		Post-HFFT		P-value
	N	Mean ± SD	N	Mean ± SD	
Screening pain score at ED triage	60	51.72%	123	86.62%	<0.001**
ED triage pain score	60	6.12±3.16	123	6.07±3.15	0.917
Time to first pain medication (minutes), median (IQR)	78	90 (65–126)	111	75 (50–113)	0.058
Analgesic used	78	67.24%	111	78.17%	0.049**
ED length of stay (hours)	116	3.51 (2.53–4.77)	142	3.32 (2.5–4.36)	0.220
Screening pain score at ED disposition	14	12.07%	80	56.34%	<0.001**
ED disposition pain score	14	2.36±2.80	72	3.88±2.57	0.049**
Time to operation (hours)	100	86 (42–149.5)	120	50 (35.5–69)	<0.001**
Delirium in 48 hrs	9	7.76%	10	7.04%	0.827

Note: **Significance P-value < 0.05.
Abbreviations: HFFT, Hip Fracture Fast-Track protocol; IQR, interquartile range; SD, standard deviation; ED, emergency department; hrs, hours.

procedures: seven were on anticoagulants, 28 were on antiplatelet agents, and six had reduced platelet counts of less than 100,000. No information about contraindications to regional anesthesia was found for 73 patients in the EHR.

There was no significant difference in the 48-hour rate of delirium between the two groups (pre-HFFT, 7.76% vs post-HFFT, 7.04%; p < 0.827). In the first analgesic treatment, 80% of the patients received tramadol with ondansetron. Nausea was reported by one patient in the pre-HFFT phase and one patient in the post-HFFT phase.

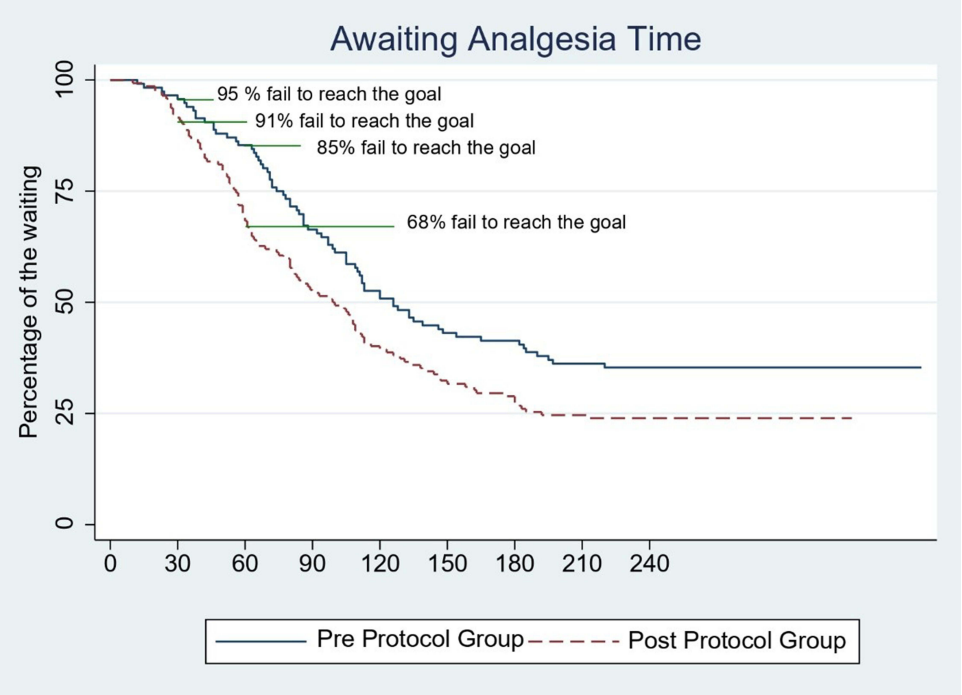

Figure 2 Time to event analysis. Number of patients awaiting analgesia in pre- and post-HFFT protocol periods. The Y-axis represents the delay time from triage to the first analgesia administration.

Table 3 Choice of Analgesia in Pre-HFFT and Post-HFFT Protocol

Analgesic Methods	Pre-HFFT n=116 (100%)		Post-HFFT n=142 (100%)		P-value
Tramadol intravenous	46	39.66%	39	27.46%	0.038**
Morphine intravenous	19	16.38%	37	26.06%	0.061
Fentanyl intravenous	11	9.48%	25	17.61%	0.061
Ketamine intranasal	3	2.59%	3	2.11%	0.802
Regional anesthesia in the ED					<0.001**
Fascia iliaca compartment block	0	0.00%	20	14.08%	0.009**
Pericapsular nerve group block	0	0.00%	8	5.63%	

Note: **Significance P-value < 0.05.
Abbreviations: HFFT, Hip Fracture Fast-Track protocol; ED, emergency department.

Discussion

This study is one of the first investigations into the impact of a fast-track hip fracture program on ED pain management for hip fractures in older adults within a middle-income country.

Overall, our results demonstrated earlier pain assessments, increased analgesic use, and more frequent regional nerve blocks (FICB and PENGB) after implementing the HFFT protocol. Despite ongoing efforts to educate staff about the protocol, the proportion of patients reporting severe pain who met the 30-minute criteria increased from 5% to 9% after the protocol's implementation.

Pain Evaluation and Analgesic Medications

The pain evaluation at triage and ED disposition in the pre-HFFT protocol had a low score (51.72%), consistent with the findings of an Iranian study by Sepahvand et al.[8] The post-HFFT protocol showed a notable improvement (86.62%), possibly attributed to the implementation of a structured nurse evaluation methodology. Although the time to initial analgesia decreased to 75 min in the post-HFFT group, no statistically significant difference was observed compared to the pre-HFFT protocol group ($p = 0.058$). This lack of significance may be attributed to constraints in the national nursing license in Thailand, which prohibits the independent administration of intravenous drugs by nurses, after performing a pain assessment triage and determining a patient's need for medication. In order to provide medication, nurses have to wait for a doctor's order. Our results are consistent with a study conducted in the United States by Casey et al[6] in terms of decreased time (pre-geriatric hip fracture program [GFP] period median time: 103 min and post-GFP median time: 93 min, $p = 0.04$). In contrast, research conducted by Patrick et al,[25] on patients who were older than 19 years and had a primary diagnosis of renal colic, hip fracture, or sickle cell disease revealed that the median waiting time for analgesia increased from 64 minutes to 80 minutes following the implementation of the protocol.

The percentage of administered analgesics increased from 67.24% to 78.17%. According to Sepahvand et al,[8] the percentage of patients who received analgesia increased from 20% before the intervention to 75.8% post-intervention. Additionally, Fosnocht et al[7] demonstrated how the pain triage procedure increased the number of patients receiving pain medication.

The data from our study indicated a lower assessment rate (12.07%) for the pain score at ED disposition in the pre-HFFT protocol compared to the post-HFFT protocol, which may not accurately represent the overall score.

The rate of tramadol administration was also lower in the post-HFFT group. It is possible that, prior to the protocol, EPs chose tramadol over strong opioids (morphine and fentanyl) for moderate-to-severe pain due to concerns about the side effects of strong opioids. However, after the protocol implementation, the rate of strong opioid administration increased. Although there is a procedure for administering ketamine intravenously and intranasally, our personnel are still unfamiliar with its use, as evidenced by the lower rate of ketamine use in our data. Future resident and staff education initiatives may lead to increased ketamine use.

Ultrasound Guideline Regional Anesthesia

Our study demonstrated the feasibility and safety of ultrasound-guided FICBs and PENGBs performed in the ED by EPs. To minimize the risk of systemic toxicity from local anesthetics and prevent direct harm to the femoral nerve and femoral vasculature, FICBs and PENGBs were chosen over femoral nerve blocks. The safety profile observed in our investigation was consistent with that reported in earlier studies.[6,20,22,23] PENGBs selectively inhibited the sensory function of the femoral nerve while preserving its motor function. As we performed the procedure after obtaining X-ray results and during waiting periods for the orthopedic physicians to assess patients in the ED, FICBs and PENGBs did not affect the duration of stay in the ED or the time needed for imaging. Our findings demonstrate that managing a patient's ED pain with FICBs and PENGBs is possible without delaying other aspects of hip fracture care.

Limitations

Due to the retrospective nature of our study, healthcare providers may have assessed the pain scores without recording them. We demonstrated a correlation rather than causality between the HFFT program and the results. By including all patients who had hip fractures during the relevant period, we were able to reduce sampling bias. However, we were unable to reduce confounding by unmeasured factors (confounding by indication) because we were unable to collect data for a multivariate analysis of factors related to pain management outcomes, such as ED overcrowding, nurse experiences, and experiences with pain management by emergency medicine residents.

Numerous staff members assessed the pain score, making it impossible to assess interrater reliability. However, the PAINAD and the numerical rating scale both exhibited good inter-rater reliability in the literature.[26,27] We assessed analgesics used exclusively in the ED; we did not assess the type of analgesics used in-hospital or the patient's administration method. We were unable to analyze the pain relief impact over time because there were insufficient pain evaluations following the administration of pain drugs. The data collection and analysis did not include information about other complications that occurred after taking pain medication. Due to the short time period of patients in the ED, our protocol used only the performance of one modality of non-medication analgesia, which allowed patients to rest in their comfort positions, which was recommended by the AAOS for hip fracture patients. We did not add other non-medical analgesic modalities to our protocol.

The impact of the HFFT program on length of hospital stay, in-hospital mortality, quality of life, patient satisfaction, and postoperative ambulation could not be assessed. Unmeasured factors may affect the results. The protocol for FICBs and PENGBs could only be performed by two EPs. Future research should focus on the relationship between pain management performance and causation. Educational initiatives for residents and staff may increase the rate of regional anesthetic performance.

Conclusion

The implementation of the HFFT protocol in one middle-income country was associated with enhanced ED pain evaluation and analgesic administration for older adults with hip fractures. Future investigations should assess the impact of these interventions on long-term patient outcomes and explore the causal association between pain treatment strategies and outcomes in older adults who present to the emergency department (ED) with hip fractures.

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Disclosure

The authors report no conflicts of interest in this work.

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