ORIGINAL RESEARCH

Analysis of Symptomatic Venous Thromboembolism Occurrence in Elderly Patients Following Total Hip Arthroplasty and the Impact of Formal Nursing Intervention

Jieli Shou, BS; Yan Li, BS; Cuiping Dong, BS

ABSTRACT

Background • Symptomatic venous thromboembolism (VTE) poses significant challenges to postoperative recovery, financial burden, and even life-threatening risks. Analyzing risk factors is pivotal for effective prevention and control strategies.

Objective • This study examines the impact and risk factors of formal nursing interventions in preventing VTE following total hip arthroplasty (THA).

Methods • A total of 80 elderly patients with hip fractures undergoing THA between January 2021 and December 2023 were randomly assigned to either the control (Ctrl) group (n=40) receiving routine nursing or the observation (Obs) group (n=40) receiving formal nursing intervention. Risk factors were analyzed, including perioperative indicators, limb circumference, VTE incidence, hip function score, self-care ability, and nursing satisfaction.

Results • The Obs group exhibited a lower postoperative VTE incidence than the Ctrl group ($P < .05$). Postoperative hip Harris score and 7-day Barthel score in the Obs group surpassed those in the Ctrl group ($P < .05$). Peripheral diameters of affected limbs in the Obs group were smaller ($P < .05$). Nursing satisfaction was higher in the Obs group (95.0%) than in the Ctrl group (75.0%) ($P < 0.05$). Risk factors for symptomatic VTE after THA included age ≥ 72 years [OR=2.937, 95% CI (1.037-8.763)], length of stay > 14 days [OR=4.724, 95% CI (1.726-13.829)], and history of cerebral infarction [OR=4.837, 95% CI (1.625~7.839)].

Conclusions • Scientific and regular nursing interventions during THA's perioperative period demonstrate a significant preventive effect on VTE, urging clinical application and promotion. Patients aged ≥ 72, with prolonged hospital stays and a history of cerebral infarction, are high-risk groups for symptomatic VTE. Nurses must closely monitor patients' clinical manifestations and vital signs post-surgery for early VTE identification. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

Hip fractures are common lower limb injuries in clinical practice. The primary intervention for hip fractures is surgical treatment.[1–4] Venous thromboembolism (VTE) manifests as venous deposition, vascular cavity obstruction, limb swelling, pain, and superficial vein dilatation due to primary or secondary factors.[5–7] VTE comprises deep venous thrombosis (DVT) and pulmonary thromboembolism (PTE).[7] In recent years, there has been a noticeable rise in the incidence, missed diagnosis, disability, and mortality rates associated with symptomatic VTE.[8–10] This surge has posed a significant challenge for clinicians, emerging as a pivotal issue requiring attention.

Based on previous clinical practice, it is observed that hip fracture patients frequently require prolonged bed rest post-surgical treatment, substantially elevating the risk of VTE incidence. The occurrence of VTE after total hip arthroplasty (THA) is notable, with an approximate incidence of 35%–37% if preventive measures are not implemented. Patients experiencing symptomatic VTE typically manifest evident swelling and pain in the lower limbs, coupled with clinical symptoms such as chest pain, chest tightness, and dyspnea.[11–14] VTE is a condition responsive to various preventive interventions and can demonstrate significantly satisfactory prevention outcomes through systematic and effective intervention.

Systematic and effective interventions yield highly satisfactory prevention outcomes. It has been observed that the implementation of effective anticoagulation prevention and physical preventive measures by postoperative patients

reduces the incidence of symptomatic VTE to 1.5%.[15–17] Nurses, serving as primary caregivers during hospitalization, assume a pivotal role in early thrombosis assessment, facilitating the prompt identification of high-risk VTE patients. This role is essential for implementing personalized health promotion and preventive measures. Strengthening nursing interventions for VTE is imperative to ensure the well-being of post-THA patients.[18–20]

Despite notable progress, there is still a need for interventions tailored explicitly to elderly patients with hip fractures undergoing THA. Therefore, this study focuses on 80 elderly THA patients, examining the impact of formal nursing intervention on VTE incidence. The aim was to shed light on the effectiveness of targeted nursing interventions, contributing valuable insights to enhance preventive and therapeutic strategies. This research addresses a crucial concern in caring for elderly THA patients, striving to improve overall patient outcomes.

METHODS

Study Design

This study retrospectively included 80 elderly patients with hip fractures who underwent THA at our hospital between January 2021 and December 2023. The cohort comprised 42 females and 38 males, with an average age of (68.5±9.4) years, ranging from 65 to 89 years. Grouping was conducted using the random number table method, resulting in the control (Ctrl) group (n=40) receiving routine nursing and the observation (Obs) group (n=40) receiving formal nursing intervention.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows: (1) Patients aged over 65 years; (2) Patients diagnosed with orthopedic-related diseases planning to undergo hip fracture surgery; (3) Preoperative color ultrasound examination revealing no thrombosis; and (4) Patients demonstrating good tolerance, willingness to participate in the experiment, and the ability to actively cooperate with follow-up interviews.

Exclusion criteria were as follows: (1) Patients with other diseases, including lower limb and pelvic fractures; (2) Patients with poor body tolerance; (3) Patients with a history of VTE; and (4) Patients with contraindications to surgery.

Nursing Interventions for VTE Prevention in THA Patients

The patients in the Ctrl group received standard preoperative and postoperative nursing in accordance with orthopedic routines. The Obs group subjects underwent nursing interventions employing various methods.

Preoperative Intervention

Preoperative intervention in the observation (Obs) group involved a comprehensive approach encompassing patient education, psychological support, lifestyle guidance, and targeted assessments for high-risk patients. We employed different specific strategies, including the following:

Education and Evaluation. Patients and their families received detailed information upon admission regarding the potential risks of VTE. The causes and processes of VTE were explained to enhance awareness and encourage active cooperation with clinical interventions.

Psychological Education. Patients and their families received enhanced psychological education, focusing on fostering a correct understanding of the surgical procedure and the associated risks of VTE. The primary objective was cultivating a positive and optimistic attitude among patients, promoting their acceptance of surgical treatment. This comprehensive psychological education aimed to empower individuals with the knowledge to navigate the surgical process and proactively engage in their healthcare journey.

Cultivation of Healthy Living Habits. Patients were actively instructed to adopt and sustain healthy living habits. This strategy encompassed adherence to a consistent sleep schedule, promoting an early-to-bed and early-to-rise routine. Additionally, patients were advised to steer clear of late-night activities and to discontinue both smoking and alcohol consumption. This multifaceted approach aimed to instill positive lifestyle changes conducive to overall well-being and optimized recovery.

High-Risk Patient Assessment. For identified high-risk patients, a comprehensive evaluation of vascular conditions was undertaken through preoperative color ultrasound and computed tomography (CT) scans. This proactive assessment aimed to achieve a targeted understanding of individual risk profiles. These preoperative interventions were designed to include important facets of patient care, ensuring a holistic approach to VTE prevention and optimizing overall patient outcomes.

Postoperative Intervention

After the operation, the postoperative intervention involved the following:

Affected Limb Elevation Guidance. Patients were advised to elevate the affected limb as early as possible, provided their medical condition allowed. This action aimed to facilitate blood return. Care was emphasized in elevating the lower leg and ankle joint as a cohesive unit. This postoperative strategy prioritized the prompt initiation of beneficial measures while ensuring proper technique to enhance patient recovery.

Functional Exercise Guidance. In terms of functional exercise, medical staff tailored activities to the patient's individual situation and encouraged different degrees of active and passive functional exercise. On the first day post-surgery, due to severe trauma, forcibly massaging and squeezing were not recommended. Instead, patients were advised to perform slight movements, such as those involving the ankle joint and metacarpal and phalangeal joints. Patients were motivated to engage in flexion and extension exercises targeting the lower limbs, hips, knees, and quadriceps as early as possible. Furthermore, passive functional exercises were employed to strengthen the lower limb muscle group

appropriately. This multifaceted approach ensured a gradual and tailored progression in postoperative functional exercises for optimal recovery.

Physical Measures. In terms of physical measures, various interventions, including plantar pump therapy, pneumatic therapy, elastic stockings, and airwave therapy apparatus, were adopted to enhance muscle pressure and accelerate blood flow.

Reduction of Puncture Times and Tourniquet Use Time. Lower limb vein puncture times and tourniquet use time were minimized as much as possible. This approach prioritized the optimization of procedures to minimize potential complications and enhance overall patient comfort during postoperative care.

Strengthened Psychological Education. Psychological education was intensified, emphasizing the encouragement of patients to maintain a positive state of mind and confront pain in a constructive manner.

Dietary Recommendations. Patients were motivated to increase water intake and consume easily digestible and excretable food, promoting overall well-being during recovery.

Discharge Education. We provided tailored and comprehensive discharge education. The post-discharge Health Education Form was provided to ensure continued communication with patients post-discharge. Timely understanding of the patient's pathological changes allowed for accurate guidance and ongoing support beyond the hospital stay. This comprehensive approach to discharge education was aimed at fostering a smooth transition to post-hospital life.

Evaluation and Assessment of Symptomatic VTE

Orthopedic specialist nurses employed the Caprini scale to evaluate the VTE risk among the subjects. Measurements were taken 10 cm above and below the knee for high-risk patients. Observations included (1) assessing the presence of lower extremity swelling (considering a circumference increase of over 3 cm before the operation as swelling) and (2) checking for a positive Homan sign. The nurse engaged with patients to inquire about any lower extremity pain. Continuous 24-hour ECG monitoring and regular examination and observation of vital signs, blood oxygen saturation, and heart rate were conducted. Symptoms and signs were further assessed using the Wells score, while Doppler ultrasound was utilized for DVT detection, and CT pulmonary angiography confirmed the presence of PTE. This comprehensive evaluation process ensured a thorough examination of potential symptomatic VTE indicators.

Observation Indicators

Incidence of Postoperative VTE. The incidence of postoperative VTE was closely monitored, aiming to assess and address potential complications in the recovery process. This indicator served as a crucial measure in ensuring postoperative well-being and guiding preventive interventions.

Assessment of Hip Function on the Affected Side. The evaluation of hip function on the affected side employed the Harris score,[21] offering a comprehensive assessment with a maximum score of 100. A higher score was indicative of superior hip function, guiding the medical team in assessing the patient's postoperative recovery and rehabilitation progress effectively.

Self-Care Ability Assessment. The assessment of self-care ability utilized the Barthel Index (BI),[22] which encompasses a full score of 100. A higher score on the BI indicated an improved level of self-care ability in the patient. This evaluation played a crucial role in assessing the patient's independence and capability to manage daily activities postoperatively.

Nursing Satisfaction Assessment. The evaluation of nursing satisfaction employed a structured approach, categorizing responses into three levels: basically satisfied, satisfied, and very satisfied. This comprehensive assessment allowed for a detailed examination of postoperative outcomes and provided valuable insights into the level of patient contentment with the nursing care received. The multi-tiered satisfaction scale ensured a nuanced understanding of the patient experience, aiding in continuous improvement and patient-centered care.

Statistical Analysis

The collected data was input into the computer to create a database, and statistical data analysis was conducted using SPSS 19.0 (IBM, Armonk, New York, USA). Scores conforming to normal distribution were represented as ($\bar{x}\pm s$), and a t-test was employed. Patient demographic data were presented as frequency and percentage [n (%)], utilizing the χ^2 test for analysis. Univariate analysis of symptomatic VTE formation employed the χ^2 test, while multivariate analysis was conducted through logistic regression analysis. Statistical significance was set at $P < .05$.

RESULTS

Patient Demographics and Baseline Characteristics

The clinical data reveals that among the 80 elderly patients who underwent THA, there were 42 females and 38 males. The average age was (68.5±9.4) years, with an age range from 65 to 89 years. All elderly patients underwent unilateral THA, and there were no significant differences in sex, age, fracture type, and drug use between the two groups ($P > .05$), see Table 1. These findings establish a comparable baseline for both groups, forming a robust foundation for subsequent comparative analyses.

Incidence of VTE in Comparison

Both groups of elderly patients successfully underwent THA. Within 30 days of post-surgery, the Obs group exhibited a lower incidence of postoperative VTE, DVT, and PTE compared to the Ctrl group. Specifically, the Obs group reported incidence rates of 0% for DVT, 2.5% for PTE, and an overall VTE incidence of 2.5%. In contrast, the Ctrl group

Table 1. Comparision of Clinical Data Between The Two Groups

Item	Ctrl Group (n=40)	Obs Group (n=40)	*P* value
Sex			>.05
Male	21	17	
Female	19	23	
Average Age (Years Old)	67.5±8.7	69.3±9.2	>.05
Type of Fracture			>.05
Femoral Neck Fracture	19	17	
Intertrochanteric Fracture Of The Femur	16	14	
Fracture Of Femoral Head	5	9	
Postoperative Drug Use			>.05
Heparin	6	10	
Factor Xa Inhibitor	15	13	
Vitamin K Antagonist	19	17	

Note: *P* values were calculated using appropriate statistical tests. $P > .05$ indicate no significant difference between the Ctrl Group (Control group) and Obs Group (Observation group) for the respective parameter.

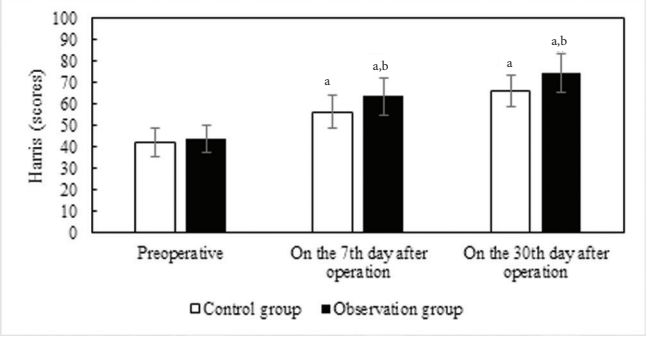
Table 2. Comparison of VTE Occurrence Between The Two Groups (n=80)

Group	Symptomatic DVT		Symptomatic PTE		Symptomatic VTE		*P* value
	Cases	Incidence Rate (%)	Cases	Incidence Rate (%)	Cases	Incidence Rate (%)	
Ctrl Group (n=40)	2	5.0	3	7.5	5	12.5	
Obs Group (n=40)	0	0	1	2.5	1	2.5	<.05

Note: $P < .05$ indicate a significant difference between the Control (Ctrl) Group and Observation (Obs) Group for the respective parameter.

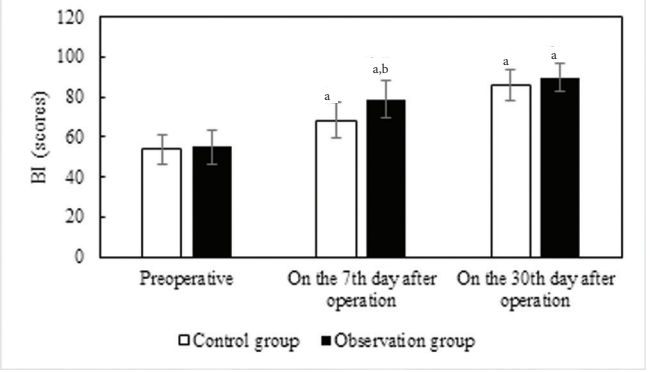
Abbreviations: DVT, deep vein thrombosis; PTE, pulmonary thromboembolism; VTE, venous thromboembolism.

Figure 1. Comparison of Postoperative Harris Hip Scores



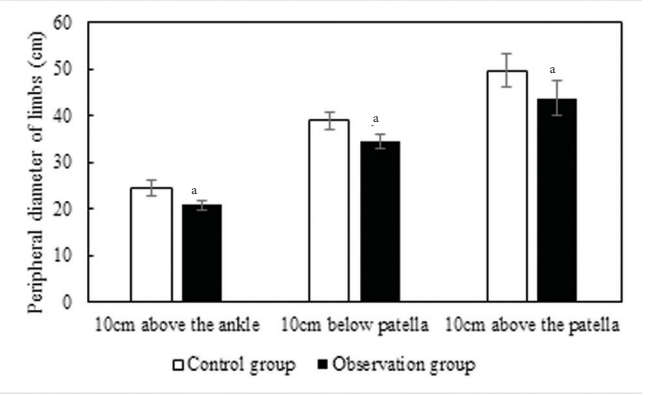
[a]Statistical significance ($P < .05$) compared to preoperative scores
[b]Statistical significance ($P < .05$) compared to the Ctrl group.

Figure 2. Comparison of BI Scores of Self-Care Ability



[a]Statistical significance ($P < .05$) compared to preoperative scores
[b]Statistical significance ($P < .05$) compared to the Ctrl group.

Figure 3. Comparison of Limb Circumference



[a]Statistical significance ($P < .05$) compared to the Ctrl group.

showed higher rates, with 5.0% for DVT, 7.5% for PTE, and an overall VTE incidence of 12.5%. The observed differences were statistically significant ($P < .05$); refer to Table 2.

Comparison of Postoperative Harris Hip Scores

The postoperative Harris hip scores demonstrated significant improvement in both groups compared to pre-surgery scores ($P < .05$). Notably, the Obs group exhibited superior postoperative Harris hip scores compared to the Ctrl group, with statistical significance evident at 7 and 30 days after surgery ($P < .05$), see Figure 1. This comparison highlights the favorable postoperative hip function outcomes in the Obs group, emphasizing the potential benefits of the implemented interventions.

Comparison of Barthel Index (BI) Scores for Self-Care Ability

The postoperative BI scores reflecting self-care ability in both groups exhibited significant improvement compared to pre-surgery scores ($P < .05$). Specifically, the Obs group demonstrated superior BI scores for self-care ability compared to the Ctrl group at seven days post-surgery ($P < .05$). However, there was a slight non-significant difference between the two groups 30 days after surgery ($P > .05$), refer to Figure 2. This comparison underscores the initial advantages of the interventions in the Obs group, highlighting their impact on early postoperative self-care outcomes.

Comparison of Limb Circumference

Limb circumference measurements were conducted once a day, three days before surgery, in both groups. Specifically, the peripheral diameters of the affected limbs at three key locations, including 10 cm above the ankle, 10 cm below the patella, and 10 cm above the patella, were accurately compared between the Obs and Ctrl groups. These preoperative measurements served to establish baseline values. The findings presented in Figure 3 highlight that, at the preoperative stage, the Obs group exhibited smaller peripheral diameters compared to the Ctrl group ($P < .05$). This observation suggests potential preoperative benefits associated with the interventions in the Obs group.

Comparison of Nursing Satisfaction

The nursing satisfaction among patients in the Obs group was notably higher at 95.0% compared to the Ctrl group, which reported a satisfaction rate of 75.0% ($P < .05$), see Table 3. This comparison underscores the superior satisfaction levels associated with the nursing interventions implemented in the Obs group, highlighting the positive impact of the tailored care provided.

Univariate Analysis of Symptomatic VTE Formation

The results of the univariate analysis using the χ^2 test revealed a significant association between the incidence of symptomatic VTE and various factors such as age, anesthesia methods, hospital stays, and histories of cerebral infarction ($P < .05$), refer to Table 4. This comprehensive analysis sheds light on the individual contributions of these factors to the formation of symptomatic VTE in patients, providing valuable insights for further investigation and preventive strategies.

Multivariate Logistic Regression Analysis of Symptomatic VTE Formation in Patients

In the multivariate logistic regression analysis, age, mode of anesthesia, length of stay, and history of cerebral infarction served as independent variables, with symptomatic VTE as the dependent variable. Notably, age ≥ 72 years old [OR=2.937, 95% CI (1.037-8.763)], hospital stay > 14 days [OR=4.724, 95% CI (1.726-13.829)], and a previous history of cerebral infarction [OR=4.837, 95% CI (1.625~7.839)] emerged as significant risk factors for symptomatic VTE after THA, see Table 5. These results provide critical insights into the factors contributing to VTE formation, facilitating targeted interventions for high-risk patients undergoing THA.

DISCUSSION

Common risk factors for VTE encompass trauma, malignant tumors, medical conditions, and surgical procedures, with a particular emphasis on VTE resulting from hip fracture surgery.[23–25] The elderly population, characterized by diminished organ function and reduced blood flow velocity, often presents with comorbidities such as hypertension and diabetes. Post-THA, patients experience an increased incidence of VTE attributed to pain and limited mobility, significantly impacting hip joint functional recovery.[26–29] Consequently, implementing effective and tailored formal nursing interventions for elderly patients undergoing THA becomes imperative to mitigate these risks and enhance overall patient outcomes.

Prolonged bed rest preceding surgery for elderly patients with hip fractures often leads to reduced lower limb activity, sluggish blood flow, and a heightened risk of stasis. The blood tends to be in a hypercoagulable state, impeding swift recovery post-surgery. Consequently, compromised activity levels increase the susceptibility to VTE. Studies have demonstrated that proactive posture care is crucial in enhancing blood circulation and mitigating the formation of thrombosis.[30–32]

Table 3. Comparison of Nursing Satisfaction Between The Two Groups

Satisfaction Level	Ctrl Group (n=40)	Obs Group (n=40)
Basically Satisfied	2	6
Percentage (%)	5.0	15.0
Satisfied	12	17
Percentage (%)	30.0	42.5
Very Satisfied	16	25
Percentage (%)	40.0	62.5
Dissatisfied	10	2
Percentage (%)	25.0	5.0
Total Satisfaction (%)	75.0	95.0
P value	<0.05	

Note: $P < .05$ indicate a significant difference between the Control (Ctrl) Group and Observation (Obs) Group for the respective satisfaction parameter.

Table 4. Univariate Analysis of Symptomatic VTE Formation In Patients

Item	Symptomatic VTE	χ^2	*P* value
	No (n=74)	Yes (n=6)	
Sex			
Male	34	4	> .05
Female	40	2	
Age (Years)			
≥72	25	3	< .05
<72	49	3	
Methods of Anesthesia			
Subarachnoid - Epidural	17	1	< .05
General Anesthesia	36	5	
Others	21	0	
Number of Hospitalizations			
1	25	1	> .05
≥2	49	5	
Length of Stay (Days)			
≤7	37	5	< .05
7~14	25	1	
>14	12	0	
Hypertension			
No	53	3	> .05
Yes	21	3	
History of Cerebral Infarction			
No	63	6	< .05
Yes	11	0	
Coronary Heart Disease			
No	61	4	> .05
Yes	13	2	

Note: χ^2 values and *P* values were calculated using appropriate statistical tests. $P < .05$ indicate a significant difference.

Table 5. Multivariate Logistic Regression Analysis of Symptomatic VTE Formation In Patients

Dependent Variable	Regression Coefficient	Standard Error	Wald χ^2	*P* value	OR	95% CI Upper Limit	95% CI Lower Limit
Age ≥72 Years Old	1.271	2.735	5.83	0.021	2.937	1.037	8.763
Length Of Stay > 14 Days	1.526	0.653	8.672	0.015	4.724	1.726	13.829
Having History of Cerebral Infarction Or Not	1.425	2.765	7.36	0.043	4.837	1.625	7.839

Note: Wald χ^2 (chi-square) values assess the significance of each predictor. *P* values indicate the statistical significance of each predictor. Regression coefficients represent the change in the log odds of the outcome for a one-unit change in the predictor. Odds Ratios (OR) express the odds of the outcome for one group compared to the reference group, with 95% confidence intervals (CI) indicating the range of plausible values.

This study implemented a holistic approach, delivering comprehensive health education to elderly patients undergoing THA. Through standardized patient positioning and formal nursing intervention, patients and their families gained a deeper understanding of postoperative hip fracture recovery and VTE. The initiative aimed to enhance patient and family

compliance, ensuring that patients maintained a scientifically supported position post-surgery. Regular activities such as turning over, back-patting, and massage were systematically conducted to expedite local blood circulation, thereby minimizing the likelihood of VTE occurrences.

In this study, scientific functional exercises targeting affected limbs were employed to mitigate the risk factors associated with VTE. The outcomes revealed a significantly lower incidence of VTE in the Obs group compared to the Ctrl group ($P < .05$), aligning with the findings of Goh et al.[33] Early rehabilitation training post-THA not only alleviated joint pain but also mitigated joint contracture and muscle adhesion resulting from perioperative immobilization. Moreover, the postoperative Harris hip score in the Obs group surpassed that of the Ctrl group, exhibiting statistical significance at 7 and 30 days post-surgery ($P < .05$). These results underscore the positive impact of the implemented interventions on both VTE incidence and hip joint functional recovery.

Moreover, the BI score reflecting postoperative hip self-care ability in the Obs group surpassed that in the Ctrl group ($P < .05$). This result suggests that formal nursing intervention plays a pivotal role in enhancing patients' self-care capabilities and expediting joint function recovery. The nursing satisfaction rate in the Obs group (95.0%) surpassed that in the Ctrl group (75.0%) ($P < .05$). As curative effects improved, patients' satisfaction with perioperative nursing demonstrated noteworthy enhancements, underscoring the positive correlation between effective nursing interventions and overall patient satisfaction.

Furthermore, the study suggested that age ≥ 72 years old, a hospital stay exceeding 14 days, and a history of cerebral infarction were identified as risk factors for symptomatic VTE after THA. Amarase et al.[34] identified age ≥ 75 years as a risk factor for VTE post-THA, supporting our findings. This consistency highlighted the age-related vulnerability of elderly patients, marked by a gradual deterioration in systemic health, diminished coagulation system responsiveness, and an increased likelihood of vascular complications such as endothelial injury, atherosclerotic plaque formation, and vascular hardening. These factors collectively contribute to a heightened risk of VTE in the elderly population.

Furthermore, a hospital stay exceeding 14 days emerges as a risk factor for symptomatic VTE. This association is attributed to patients presenting with diverse cardiovascular and cerebrovascular conditions preoperatively, coupled with an inherently unstable postoperative state. Prolonged, bedridden immobility during the recovery period contributes to compromised lower limb blood circulation, fostering VTE incidence.

Individuals with a history of cerebral infarction constitute a high-risk demographic for VTE. Surgical stimuli, coupled with postoperative bed rest, elevate the risk of VTE in this population. Therefore, in the realm of clinical nursing, focused attention on individuals with these identified risk factors is paramount. Conducting VTE risk assessments and motivating patients to initiate early functional exercises are crucial interventions for mitigating these risks.

In this study, two patients exhibited symptomatic DVT, manifesting with calf pain and swelling. The nurse conducted measurements of calf circumference and monitored vital sign variations, leading to a diagnosis of DVT for these individuals. Furthermore, two patients with symptomatic PTE experienced diminished oxygen saturation levels (SpO_2) post-surgery. Notably, one patient encountered a brief loss of consciousness during the initial occurrence of PTE-related symptoms.

Hence, nurses must be vigilant regarding the following aspects of patient care: (1) Monitoring and promptly assessing lower leg pain and swelling, detecting alterations in lower leg circumference, and promptly identifying potential DVT or PTE; (2) The assigned nurse should closely observe changes in patient's vital signs, including elevated heart rate, reduced SpO_2, and brief episodes of unconsciousness. Proactive management and immediate response to the onset of DVT and PTE during their shifts are crucial responsibilities.

During shift handover, both nurses must tasked with vigilantly assessing changes in the circumference of the patient's calves, with a high suspicion for PTE if there is an increase exceeding 3 cm; (4) The nurse must be attentive to potential bleeding manifestations during the administration of anticoagulant drugs, including but not limited to gingival bleeding, retinal bleeding, and skin bruising. Observations should also encompass any signs of vomiting and nausea, with an emphasis on examining the coloration of the vomit.

Our study offers valuable insights into the effectiveness of formal nursing interventions in preventing VTE in elderly patients undergoing THA. The comprehensive nursing care approach showcased positive outcomes, including a reduction in VTE incidence, improved recovery of joint function, and heightened patient satisfaction. Despite the encouraging findings, it is crucial to acknowledge the study's limitations.

Study Limitations

We acknowledge certain limitations that may impact the generalizability of our findings. Firstly, the relatively small sample size in this single-center study may limit the external validity of our conclusions. While the observed outcomes are promising, caution should be exercised in extrapolating these findings to broader populations. Larger-scale, multicenter studies are warranted to enhance the robustness and generalizability of the results. Additionally, the single-center nature of the study introduces the potential for selection bias and may not fully capture the diversity of patient populations and healthcare practices in different settings. Future research endeavors should aim for multi-center collaborations to encompass a more comprehensive representation of patient demographics, clinical practices, and healthcare infrastructure. Further research is needed to validate and expand upon these results.

Clinical Implications

In accordance with the latest VTE guidelines, this study focused on a holistic approach involving medical care, nursing,

and patient engagement. A comprehensive suite of formal nursing intervention programs for VTE was carefully developed, covering the entire continuum of care from admission to discharge. Our findings unequivocally demonstrate that consistent nursing interventions significantly enhance preventive efficacy against VTE. The clinical implications of these results are noteworthy and hold substantial potential benefits for both patients and healthcare providers.

For Patients. (1) Improved Patient Outcomes: The implementation of regular nursing interventions, as outlined in our study, results in a significant reduction in VTE incidence among THA patients. This, in turn, contributes to improved postoperative recovery and joint function. (2) Enhanced Patient Satisfaction: The integration of systematic nursing interventions positively influences patient care experiences. Through the active involvement of patients and their families in comprehensive health education and formal nursing practices, we empower them with valuable knowledge and support, fostering a sense of participation and satisfaction in their care journey.

For Healthcare Providers. (1) Guidance for Clinical Practice: Our study offers actionable insights for healthcare providers to adopt and implement evidence-based nursing interventions for VTE prevention. The structured nursing intervention programs, when integrated into routine clinical practice, provide a practical guide to enhance patient care and outcomes. (2) Risk Mitigation and Early Detection: The focus on systematic nursing interventions facilitates the identification and mitigation of VTE risk factors, especially in elderly patients undergoing THA. Nurses, as frontline caregivers, play a pivotal role in early detection and intervention, reducing the likelihood of symptomatic VTE and enhancing overall patient safety. (3) Clinical Promotion and Protocol Development: The favorable outcomes underscore the potential for broader clinical promotion of systematic nursing interventions for VTE prevention. Developing standardized protocols based on our findings can contribute to establishing best practices in VTE prevention, fostering consistency and quality of care across healthcare settings.

Therefore, the study's findings advocate for the integration of structured nursing interventions into routine clinical practice, offering tangible benefits for patients and providing healthcare providers with practical tools to enhance VTE prevention strategies in the context of THA.

CONCLUSION

Scientific and systematic nursing interventions during the perioperative period of THA demonstrate a significant preventive effect on VTE, warranting clinical application and widespread promotion. High-risk groups for symptomatic VTE, identified as patients aged ≥72 years old, with prolonged hospital stays and a history of cerebral infarction, require special attention. Additionally, vigilant monitoring of clinical manifestations and vital signs within seven days post-surgery is crucial for early VTE detection. However, the study's limitation lies in its single-center focus on a limited number of elderly hip fracture patients. It necessitates future multicenter collaborations for a comprehensive evaluation across various cities and healthcare settings to deepen our understanding of the preventive impact of formal nursing interventions on VTE.

COMPETING INTERESTS

The authors declare that they have no competing interests

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AUTHORS' CONTRIBUTIONS

Jieli Shou designed the research study. Cuiping Dong performed the research. Yan Li conducted experiments and analyzed the data. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

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Not applicable

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethics committee of Zhejiang Hospital approved the protocol. Informed consent was obtained from all study participants. All the methods were carried out in accordance with the Declaration of Helsinki.

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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