Effect of Nursing Measures on Orthostatic Hypotension and risk of falling for Patients after Total Hip Replacement Surgery

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Abstract

Background: A notable medical issue in hospitalized individuals, orthostatic hypotension is both widespread and clinically consequential after total hip replacement, yet it remains commonly overlooked. Therefore, it is important for patients to understand the nursing measures that can help prevent orthostatic hypotension, as well as the risk of falling associated with total hip replacement. **Aim:** Evaluate the effect of nursing measures on orthostatic hypotension and risk of falling for patients after total hip replacement surgery. **Research design:** A quasi-experimental research design. **Sample:** A purposive sample of 60 patients who undergoing Total Hip Replacement. **Setting:** orthopedic department, trauma unit and its outpatient clinics at Assiut University hospital. **Tools:** Tool I; Patient assessment sheet, Tool II; Morse Fall Scale, Tool III; Orthostatic vital signs measurement, and Tool IV; Orthostatic symptoms grading scale. **Results:** After implementing nursing measures, the mean value of orthostatic vital signs and orthostatic symptoms was improved among the study group more than the control group with p value = 0.0001 as well as there were statistically significant differences between the studied groups about the risk of falling with p value= 0.001. **Conclusion:** Compared to the control group, the study group showed statistically significant improvements in orthostatic hypotension and fall risk following nursing measures. **Recommendations:** Replication of this study in multicenter trials with broader participant demographics.

Keywords: Nursing Measures, Orthostatic Hypotension, Total Hip Replacement Surgery.

Introduction

Orthostatic hypotension (postural hypotension) is characterized by a sudden drop in blood pressure upon standing or lying down. Incidence of OH following total hip replacement is about 22% from 117 in post operative period. Post-orthopedic surgical patients experience fall rates of 2.5 incidents per 1000 patient-days during hospitalization. Also, orthostatic hypotension (OH) demonstrates a pronounced age-related progression, with prevalence estimates escalating from 5-11% in middle-aged populations to ≥30% among elderly individuals **(Sarnaik & Mirzai, 2025).**

Postoperative falls represent a significant cause of morbidity in orthopedic populations, necessitating comprehensive investigation into the pathophysiology, risk stratification, and evidence-based prevention of orthostatic hypotension in this vulnerable cohort **(Figueroa et al., 2025).**

Consensus Committee of the American Autonomic Society established the current diagnostic criteria for orthostatic hypotension, defining it as a sustained reduction of ≥20 mmHg in systolic blood pressure or ≥10 mmHg in diastolic blood pressure within three minutes of assuming an upright position **(Jordan et al., 2023)**.

In orthostatic hypotension, cerebral hypoperfusion leads to symptoms such as lightheadedness, generalized weakness, cognitive fog, headaches, near-fainting sensations, and in severe cases, syncope. Following this initial phase, the body triggers compensatory autonomic mechanisms, producing secondary symptoms including nausea, chest discomfort, cold extremities, palpitations, and cold sweating, which may also culminate in syncope if compensatory efforts fail to restore hemodynamic stability **(Brailsford et al., 2025).**

Postoperative OH in orthopedic patients arises from three main causes: pharmacologic, neurogenic, and non-neurogenic factors. Pharmacologic OH is due to the frequent use of vasoactive medications like vasodilators, antihypertensives (especially α-blockers), diuretics, and opioids. Orthopedic patients often receive multiple such medications postoperatively, increasing iatrogenic risk. This risk is further exacerbated by neurogenic factors (e.g., autonomic neuropathy) and non-neurogenic factors (e.g., blood loss, dehydration, immobilization), creating a high-risk scenario for OH during early mobilization (**Rivasi et al., 2020).**

Preventing (OH) necessitates a multifactorial strategy targeting modifiable risks: medication optimization by deprescribing or reducing high-risk drugs; maintaining euvolemia through monitored fluid intake/output; and educating patients to avoid OH triggers (rapid posture changes, heat, large meals, Valsalva). Clinicians should monitor orthostatic vitals, promote gradual mobilization with physical therapy, and employ non-pharmacologic measures (compression stockings, seated leg exercises) to improve venous return

and mitigate fall risk in high-risk patients **(Wahba et al., 2022)**.

OH management focuses on fall prevention, improved orthostatic tolerance (increased standing time/reduced symptoms), and hemodynamic optimization (raising standing BP without worsening supine hypertension). First-line physical counter maneuvers target enhanced venous return through biomechanical effects, increasing peripheral resistance and boosting venous return through rhythmic lower-body contractions (30-sec intervals). Evidence-supported techniques include thigh muscle activation (e.g., leg crossing with contraction), dynamic movements (slow marching in place), and positional adjustments (leg elevation, toe raises, forward bending). These interventions should be initiated at symptom onset and combined with pharmacologic/non-pharmacologic strategies for optimal functional improvement in activities of daily living **(Palma, & Kaufmann, 2024).**

Significance of the study:

In 2023, the Orthopedic Department at Assiut University Hospital recorded 200 admissions for total hip replacement (THR) procedures **(Assiut University Admission Office Census, 2022)** This case volume provides a substantial cohort for investigating postoperative complications such as OH, particularly given this population's dual risk factors of prolonged immobilization and frequent opioid use. The dataset enables quantification of OH incidence rates and evaluation of prevention protocols in a real-world clinical setting.

Clinical observations in Assiut University Hospital's orthopedic department and outpatient clinic demonstrate a rising annual caseload of total hip replacement (THR) patients, necessitating enhanced perioperative monitoring protocols.

This population requires multidisciplinary care coordination to address life-threatening complications, with OH representing a patient safety concern due to its high incidence (20-40% post-THR) and fall-related morbidity. The present study aims to establish standardized OH assessment metrics that may: improve stabilization of orthostatic vital signs, alleviate symptoms, and decrease fall rates through timed interventions during early mobilization.

Aim:

General aim:

Evaluate the effect of nursing measures on orthostatic hypotension and risk of falling after total hip replacement patients.

This was achieved by:

1. Assess patient's orthostatic vital signs (blood pressure and pulse), risk of falling, and orthostatic symptoms before implementing nursing measures.
2. Design and implement nursing measures about orthostatic hypotension and associated risk of falling for patients after THR.
3. Evaluate the effect of nursing measures on patient's orthostatic vital signs, risk of falling, and

orthostatic symptoms after implementing nursing measures.

Research hypothesis:

- **H0:** No differences in orthostatic hypotension and risk of falling between the study group and control group after nursing measure implementation**.**
- **H1:** Study groups of patients who received nursing measures will have less risk of falling and have less orthostatic hypotension compared to control groups of patients.
- **H2**: Mean orthostatic vital signs, orthostatic symptoms will be improved among the study groups of patients compared to control groups of patients after nursing measures implementation.

Patients and method

Research design:

This study utilized a quasi-experimental design to examine the causal relationship between nursing measures (independent variable) and three primary outcomes: (1) orthostatic vital sign stability (defined as <20 mmHg systolic/10 mmHg diastolic drop within 3 minutes of standing), (2) fall risk reduction (measured by Morse Fall Scale scores), and (3) orthostatic symptom severity (using the Orthostatic Hypotension Questionnaire). Participant allocation to study (nursing measure) versus control (standard care) groups followed non-random clinical assignment.

Research setting:

This study was conducted at Assiut University Hospital, the largest care center in southern Egypt, serving a catchment area of approximately 5 million inhabitants. The research focused on three specialized units: the orthopedic inpatient department, trauma unit, and affiliated outpatient clinics. The orthopedic ward occupies the entire fourth floor, comprising separate male and female departments with identical configurations - each containing 6 patient rooms (36 beds total per department) to ensure gender-specific care standards. This high-volume setting provides an optimal environment for investigating postoperative complications like orthostatic hypotension across diverse patient demographics.

Sample

A purposive sample of 60 patients undergoing total hip replacement was divided equally (30 per group) via shuffled cards (even: control; odd: study). The study groups (received nursing measures before the operation) and the control groups (received routine instructions before the operation). After collecting pilots' study, the sample was calculated by using power analysis in the G*power (v3.1.7) program. In the calculation performed by taking the post application of preventive measure systolic blood pressure during standing position after 3 minutes for study and control groups. The mean difference between the two group was (11.83), the standard deviation for study group and control group was (8.56, 17, 6) respectively, into consideration and seeking a significance level of 0.05 (α) and a statistical testing power of 80% (1-β) the effect size was calculated to be (d)

0.427 and according to the standard deviation value (SD) the minimum sample size was found to be 23 for each group. **(Fawzy & M El-Sayed, 2023).**

Inclusion criteria:

Adult patients of both genders, aged from 21-65 years, agreed to participate in the study, who had total hip replacement surgery and were able to communicate with others.

Exclusion criteria:

Patients who had neurological or vascular disorders and disagreed with participating in the study.

Tools:

This study employed four validated tools to capture comprehensive outcome measures:

Tool I: Patient assessment sheet:

It was developed by researchers based on reviews of literature (**Gamaa et al., 2023).** It was used to assess patient's demographic data and clinical data. It comprised two validated sections:

Part 1: Demographic characteristics: such as code number, age, gender, marital status, educational level, occupation, and residence.

Part 2: Clinical data: which include vital signs, laboratory investigations, and average amount of blood loss, need to have blood transfusion, medical diagnosis, and length of surgery.

Tool II: Morse Fall Scale (MFS):

The assessment tool was originally designed by **Morse et al., 1989** as a clinical instrument for predicting fall risk in vulnerable patient populations. It was adopted by the researchers to assess a patient's likelihood of falling before the operation and after two weeks. The Morse Fall Scale (MFS) incorporates six key clinical variables: prior history of falls, presence of secondary diagnoses, use of ambulatory assistive devices, intravenous therapy or heparin lock placement, gait characteristics, and cognitive status.

Scoring system:

To obtain the Morse Fall score add the score from each category, the score is then tallied and recorded on the patient's chart. Risk level and recommended actions are then identified.

- **0:** No risk for falls, **<25:** Low risk, **25-45:** Moderate risk, and **>45:** High risk

Tool III: Orthostatic vital signs measurement:

It was adopted from **Agency for Healthcare Research and Quality, 2013, Gamaa et al., 2021, and American Heart Association, 2023,** to measure and record the selected vital signs (heart rate, systolic, and diastolic blood pressure). The measurements were collected with the patient in both supine and upright positions. Initially, the patient remained in a flat, supine position for at least 3 minutes (optimally 5 minutes), during which blood pressure and pulse were recorded. Subsequently, the patient was asked to sit for one minute before standing, after which blood pressure and pulse were reassessed following a 3-minute interval in the standing position. In cases where standing was not feasible, measurements were obtained while

the patient remained seated with legs uncrossed and feet suspended.

Scoring system:

Orthostatic hypotension is diagnosed when a patient exhibits a sustained reduction in systolic blood pressure of ≥20 mmHg or a diastolic drop of ≥10 mmHg within 3 minutes of standing. Alternatively, an increase in heart rate of ≥30 beats per minute (bpm) upon standing.

Tool IV: Orthostatic symptoms grading scale:

It was developed by **(Schrezenmaier et al., 2005).** This instrument was employed to evaluate orthostatic hypotension (OH) symptoms and their impact on activities of daily living (ADLs). The assessment comprises four core symptoms: fatigue, lightheadedness, cognitive difficulties (problems with thinking and concentrating), and visual disturbances (blurry vision). Each symptom is further categorized into five domains: symptom frequency, symptom severity, triggering conditions, effects on ADLs, and duration of symptoms while standing. The researchers used five subtitles after one day postoperative, and two weeks post operative.

Scoring system:

Each subtitle composed of 4 responses ranged from (0-4), the total score for each symptom ranged from (0-20), and the total score for all 4 symptoms ranged from (0- 80).

- Mild orthostatic symptoms <4, Moderate orthostatic symptoms 4–9, Severe orthostatic symptoms >9

Nursing measures for orthostatic hypotension and risk of falling for patient after total hip replacement:

After reviewing literature (**Criado and Kalafut, 2024, Strumia et al., 2023 and Reilly, 2024)** and previous research and articles, the researchers developed the necessary nursing measures to prevent or at least minimize orthostatic hypotension and risk of fall for patients after total hip replacement surgery. It comprised two distinct sections:

a) Theoretical part:

1- **Orthostatic hypotension:** Definition of orthostatic hypotension, causes, risk factors associated with OH, signs and symptoms of OH, complications of OH, and how the doctor diagnosis OH.

2- **Risk of falling:** what is fall, what are the intrinsic factors and extrinsic risk factors of falls (including environmental hazards or improper use of assistive devices), preventive measures to decrease the risk of falls in the subtitles of "Promotion of a better vision through regular assessment and correction", "Promotion of vitamin D to support musculoskeletal health", "Guidance on drug interactions which can cause dizziness, syncope, and malaise", "Steps of using crutches and walkers", "Guidance on increased safety attention in home through environmental adaptation and modifications , including handrails for stairs, grab rails for bathroom,

good lighting, and slip-resistant surfacing for outside areas.

b) Practical part:

1. **Orthostatic hypotension:** This comprehensive approach combines preventive strategies and symptom-reduction techniques, including (1) a gradual rising measures (rolling to one side, swinging legs over the bed edge, pushing to seated position, waiting 1-2 minutes before standing), (2) dietary modifications (increased salt intake with medical approval and adequate fluid consumption), (3) physical countermeasures (calf muscle stretches before rising, thigh/abdominal/gluteal muscle contractions), and (4) compression therapy (proper use of medical-grade stockings with correct donning/removal techniques) - all aimed at preventing sudden blood pressure drops and minimizing symptom severity through physiological stabilization and improved venous return.
2. **Risk of falling:** Exercise Component: The intervention incorporated targeted physical exercises designed to enhance muscular strength (particularly in the lower extremities) and improve balance control. These exercises underwent rigorous validation by a multidisciplinary expert panel comprising nursing specialists and orthopedic surgeons.

Content validity and reliability:

Content validity:

The assessment tools and nursing measures underwent comprehensive evaluation by a multidisciplinary review panel consisting of three professors from the Medical-Surgical and Geriatric Nursing departments at the Faculty of Nursing, and two orthopedic medicine professors from the Faculty of Medicine at Assiut University. Following their expert assessment, appropriate modifications were implemented to enhance clarity and precision of the materials.

Reliability:

The study instruments were evaluated for internal consistency using Cronbach's alpha coefficient (acceptable range: 0.5-1.0). The analysis demonstrated excellent reliability across all tools: Orthostatic Vital Signs Measurement (α=0.90), Morse Fall Scale (α=0.825), and Orthostatic Symptoms Grading Scale (α=0.94), confirming their psychometric robustness for clinical assessment.

Pilot study

A representative sample of 10% (n=6) of the total patient cohort participated in preliminary testing to evaluate both the clarity of assessment tools and the time requirements for administration. As no modifications were necessary following this pilot phase, these participants were subsequently included in the main study population.

Ethical Consideration:

This study received formal ethical approval from the Faculty of Nursing Research Ethics Committee (approval code: 1120230633; date: June 25,

2023). Institutional permissions were secured from: the Dean of the Faculty of Nursing, and the relevant clinical departments at Assiut University Hospital (Orthopedics, Trauma Unit, and Outpatient Clinic). Prior to participation, all patients received comprehensive verbal and written information about the study aims and procedures, with emphasis on their right to withdraw without consequence. Written informed consent was obtained from all participants, with strict maintenance of confidentiality throughout data collection and analysis.

Procedure:

The study data were systematically collected over a 12-month period from August 2023 to July 2024, with researchers conducting fieldwork during morning shifts (5-hour) three days per week (Saturday, Monday, and Wednesday) at the designated clinical sites. Through the following phases the data was collected:

Assessment phase

Following official approvals, researchers established direct communication with eligible patients during pre-operative visits (day before surgery). Each participant received individual study briefings including purpose explanation and consent acquisition. Patients were then randomly allocated to two equal groups using a shuffled card method. On operation day, researchers collected: demographic/clinical data via Tool I (Parts 1-2; ~5 minutes) and fall risk assessments via Tool II (Morse Fall Scale; ~5 minutes), totaling approximately 10 minutes per patient (with variation based on response time). All procedures were completed during scheduled clinical interactions to minimize workflow disruption.

Planning phase:

The researchers designed evidence-based nursing measures by synthesizing current literature from relevant journals and recent articles. These measures were delivered using multimodal educational tools, including PowerPoint presentations, instructional videos, and illustrative images to enhance comprehension. Additionally, each patient received a color-coded booklet written in simple Arabic to serve as a continuing reference, reinforcing the provided information and promoting adherence to the recommended practices.

Implementation phase

- After collecting necessary data as baseline data, the day before the operation, the control groups received the routine department instruction, while the study groups received nursing measures by the researchers.
- Preoperative researchers implement nursing measures in the presence of relatives to be a reminder and motivated to the patients in three sessions.
- The first session covered the theoretical part about orthostatic hypotension and risk of falling. The second session covered the practical part of OH (preventive measures) and the third session includes the practical part about the exercise.

- The session took approximately 30 minutes and 10 minutes for revision.
- Using printed, colorful paper and using terms and words according to the patient's education level, the researchers started to explain the nursing measures, starting by theoretical part, then practical part that focuses on prevention or at least minimize severity of symptoms of orthostatic hypotension, and teach patients actually how to wear and remove stocking by using real stocking.
- At the end of the session, the researchers give time to the patient and relatives to ask questions and summarize what is said and done.
- The researchers used the manner of reinforcement and motivation during the explanation, and every patient was given a copy of the nursing measures.

Evaluation phase

After one day postoperative in the department and two weeks postoperative in the outpatients clinic during the routine follow up, the researchers evaluated both the study and control groups of patients vital signs (heart rate, systolic, and diastolic blood pressure) by using tool III, and symptoms of orthostatic hypotension (2 times, 1 and 15 days) by using tool IV and risk of falling after 2 weeks only by using tool II. Then the researcher compared the findings for both groups.

Statistical design:

Normality was checked using the Anderson-Darling test, and variance homogeneity was confirmed. Categorical data were presented as frequencies (N, %), while continuous variables were reported as mean ± SD. Group comparisons used t-tests (two groups) or ANOVA (multiple groups), and Pearson correlation assessed scale score relationships. All tests were two-tailed with $p < 0.05$ significance, analyzed using IBM SPSS (v20.0).

Results

Table (1): Displays that two thirds of the study group (66.7%) and more than one half of control group (56.7%) were more than fifty-five years old. As regards marital status, more than two thirds of the study group (73.3%) and less than two thirds of control group (63.3%) were married. As regards level of education, one third of the study group and control group (33.3%) were primary education. As regards occupational status, less than one third of study group (26.7%) and one third of control group (33.3%) was employer. As regards residence, one half of the study group (50%) and more than one half of the control group (56.7%) were from urban areas with no statistically significant difference between study and control groups.

Table (2): Illustrates that there was statistically significant difference between study and control groups as regards diastolic blood pressure with P-value (0.036). Three fifths of study group (60%) and less than one half of the control group (46.7%) need to have a blood transfusion. More than three fifths of study group and control group (63.3%) their diagnosis were fractures. The majority of study group

(86.7) and control groups (90%) had less than 3 hours in the operation.

Table (3): Clarifies that; one day after the operation, there was a statistically significant difference between the study and control groups as regards diastolic blood pressure during standing position with (P value = 0.024), while after 2 weeks of the operation, there was a statistically significant difference between study and control groups as regard blood pressure only during the standing position with no statistically significant difference for pulse during both position**.**

Table (4): Reflects that before surgery and before implementing nursing measures the risk for fall were equal between two groups of patients (study and control) group, where the majority of study group (90%) and more than two thirds of control groups (76.7%) had high risk for falling with no statistically significant difference between two groups with p-value (0.788). While after 2 weeks and after implementing nursing measures, more than two fifths of the study group (46.7%) had moderate risk for falling while about two thirds of control group (66.7%) had a high risk of falling with statistically significant difference (P.value = 0.001).

Table (5): Demonstrates that there was a decrease in the mean of orthostatic symptoms grading among the study group after implementing nursing measures compared with the control group with statistically significant difference between two groups with (P.value = 0.001).

Table (6): illustrated that there is positive a statistically significant correlation between the risk of falling and symptoms of orthostatic hypotension, particularly fatigue and lightheadedness in the study group two weeks post-surgery with (P. value <0.05). Additionally, a stronger correlation was observed in the control group one day after surgery regarding fatigue, lightheadedness and blurry vision with (P. value <0.01).

Table (7): clarifies that there was a statistically significant difference between the risk of falling and age before and after the implementation of the nursing measures among study and control group.

Table 1: Demographic characteristics of study and control group of patients after total hip replacement surgery (n=60)

Demographic characteristics	Study		Control		P. value
	No	%	No	%	
Age group:					
Less than 40 years	**4**	**13.3**	**3**	**10.0**	**0.500**
From 40-55 year	**6**	**20.0**	**10**	**33.3**	
More than 55 years	**20**	**66.7**	**17**	**56.7**	
Mean±SD	**54.93±11.13**		**52.53±10.37**		**0.391**
Gender:					
Male	**24**	**80.0**	**21**	**70.0**	**0.371**
Female	**6**	**20.0**	**9**	**30.0**	
Marital status:					
Single	**2**	**6.7**	**1**	**3.3**	**0.460**
Married	**22**	**73.3**	**19**	**63.3**	
Widow	**6**	**20.0**	**10**	**33.3**	
Education:					
Illiterate	**9**	**30.0**	**10**	**33.3**	**0.920**
Primary education	**10**	**33.3**	**10**	**33.3**	
Secondary education	**7**	**23.3**	**5**	**16.7**	
University	**4**	**13.3**	**5**	**16.7**	
Occupational:					
Housewife	**6**	**20.0**	**9**	**30.0**	**0.772**
Employer	**8**	**26.7**	**10**	**33.3**	
Farmer	**6**	**20.0**	**5**	**16.7**	
Student	**2**	**6.7**	**1**	**3.3**	
Unemployed	**5**	**16.7**	**2**	**6.7**	
Retired	**3**	**10.0**	**3**	**10.0**	
Residence:					
Urban	**15**	**50.0**	**17**	**56.7**	**0.605**
Rural	**15**	**50.0**	**13**	**43.3**	

Chi square test for qualitative data between the two groups - Independent T-test quantitative data between the two groups - *Significant level at P value < 0.05, **Significant level at P value < 0.05

Table 2: Clinical data of study and control group of patients after total hip replacement surgery (n=60)

Clinical data	Study		Control		P.value
	No	%	No	%	
Vital signs:					
Pulse	84.9±11.29		82.9±9.11		0.453
SBP	119.67±11.29		122.67±11.12		0.304
DBP	75.67±7.74		79.83±7.25		0.036*
Laboratory investigations:					
HG	12.37±2.33		12.33±1.65		0.949
RBCs	4.61±0.85		4.51±0.86		0.722
Amount of blood loss	1±0.53		0.97±0.52		0.859
Need to have a blood transfusion:					
No	12	40.0	16	53.3	0.301
Yes	18	60.0	14	46.7	
Medical diagnosis:					
Fracture	19	63.3	19	63.3	0.901
Arthritis	7	23.3	8	26.7	
Osteoporosis	4	13.3	3	10.0	
length of surgery:					
Less than 3 h	26	86.7	27	90.0	0.688
From 3 h and more	4	13.3	3	10.0	

Chi square test for qualitative data between the two groups - Independent T-test quantitative data between the two groups - *Significant level at P value < 0.05, **Significant level at P value < 0.001

Table 3: Orthostatic vital signs measurement for study and control group of patients after total hip replacement surgery with one day and after 2 weeks (n=60)

Vital signs	After one day			After 2 weeks		
	Study	Control	P.value	Study	Control	P.value
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Laying position:						
SBP	112.33±10.4	116.33±14.02	0.214	122.5±9.35	109±12.13	0.000**
DBP	74.67±6.81	75.83±8.31	0.555	78.83±4.86	74±7.24	0.004**
Pulse	84.03±11.58	81.33±7.98	0.297	85.57±8.54	81.6±7.01	0.054
Standing position after 3 minutes:						
SBP	122±11.86	119.33±10.81	0.366	129.83±8.56	118±21.4	0.007**
DBP	79.67±7.65	75.5±6.21	0.024*	83.33±5.47	77.67±6.26	0.000**
Pulse	85.13±9.07	84.83±7.32	0.888	89.8±7.51	86.97±8.26	0.170

Chi square test for qualitative data between the two groups- *Significant level at P value < 0.05, **Significant level at P value < 0.001

Table 4: Comparison between the study and control group before total replacement surgery and after 2 weeks of surgery according to Morse Fall Scale (n=60)

Risk of falling	Study		Control		P. value
	No	%	No	%	
Before the operation:					
Low Risk	0	0.0	1	3.3	0.313
Moderate Risk	3	10.0	6	20.0	
High Risk	27	90.0	23	76.7	
Mean±SD	61.67±21.06		60.17±21.87		0.788
After operation with 2 weeks:					
Low Risk	9	30.0	0	0.0	<0.001**
Moderate Risk	14	46.7	10	33.3	
High Risk	7	23.3	20	66.7	
Mean±SD	32.83±19.33		59.17±20.22		<0.001**

Chi square test for qualitative data between the two groups - Independent T-test quantitative data between the two groups - *Significant level at P value < 0.05, **Significant level at P value < 0.001

Table 5: Comparison between the study and control group according to orthostatic symptoms grading scale after total hip replacement surgery with one day and 2 weeks (n=60)

Orthostatic Symptoms	After one day			After 2 weeks		
	Study	Control	P.value	Study	Control	P.value
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Fatigue	11.73±3.92	13.17±1.51	0.067	5.37±4.3	14.67±3.58	0.001**
Lightheadedness	11.77±5.52	12.87±2.65	0.329	4.73±4.18	14.63±3.67	0.001**
Problems thinking and concentrating	10.77±5.33	11.57±2.25	0.452	4.63±4.57	12.73±4.14	0.001**
Blurry vision	10.2±4.58	11.43±2.46	0.199	4.53±4.16	13.67±3.99	0.001**

Independent T-test quantitative data between the two groups -*Significant level at P value < 0.05, **Significant level at P value < 0.001

Table 6: Relation between orthostatic Symptom and risk of falling for Study and Control group of patients (n=60)

Orthostatic symptoms		Risk of falling			
		Study		Control	
		After one day	After 2 weeks	After one day	After 2 weeks
Fatigue	r	0.316	.436*	.658**	0.241
	P	0.089	0.016	0.000	0.199
Lightheadedness	r	0.266	.368*	.518**	0.339
	P	0.156	0.045	0.003	0.066
Problems thinking and concentrating	r	0.005	0.217	.463*	0.205
	P	0.978	0.250	0.010	0.277
Blurry vision	r	0.199	0.186	.516**	0.337
	P	0.292	0.324	0.004	0.069

*Statistically Significant Correlation at P. value <0.05 **Statistically Significant Correlation at P. value <0.001

Table 7: Relation between risk of falling for study and Control group with their demographic data (n=60)

Demographic data		risk of falling			
		Study		Control	
		After one day	After 2 weeks	After one day	After 2 weeks
Age	r	.406*	.618**	.603**	.567**
	P	0.026	0.000	0.000	0.001
Gender	r	0.141	0.000	-0.034	0.017
	P	0.457	1.000	0.859	0.928
marital status	r	-0.074	0.279	0.249	0.281
	P	0.698	0.136	0.185	0.132
Level of education	r	-0.157	-0.115	-0.046	-0.118
	P	0.407	0.544	0.810	0.536
occupational status	r	0.150	0.276	0.173	0.108
	P	0.430	0.140	0.361	0.568
Residence	r	-0.241	-0.230	-0.220	-0.308
	P	0.199	0.222	0.243	0.098

*Statistically Significant Correlation at P. value <0.05 **Statistically Significant Correlation at P. value <0.01

Discussion

Orthostatic hypotension presents as a significant independent risk factor for multiple adverse health outcomes, most notably: increased cardiovascular morbidity, elevated fall risk with subsequent injury potential, higher all-cause mortality rates, and accelerated cognitive decline. This multifactorial risk profile underscores the critical need for early detection and proactive management of OH in clinical practice. **(Hogan et al., 2021)**. This study aimed to evaluate the effect of nursing measures on orthostatic hypotension and risk of falling after total hip replacement patients.

The current study results revealed that two thirds of the study group and more than one half of control group were older adults. **Mohammed et al., 2023** found that, the study population demonstrated a significant proportion of middle-aged participants, with over one-third of the combined cohort (both study and control) falling within the fifty- five to sixty- five years age range, **Smith et al., 2023** found the majority of the studied older adults.

Regarding to gender Distribution**:** The study population showed a male predominance, with males comprising four-fifths of the study group and approximately nearly three quarters of the control group participants. These findings agree with **Mohammed et al., 2023,** who found that two thirds of them were males. Also, agree with **Bakr, 2018,** who listed that there were two third of the study group and the control group were males. Male patients were considerably more likely than female to experience orthostatic hypotension.

Concerning marital status, more than two thirds of the study group and less than two thirds of the control group were married. This agreement with

D'Ermo et al., 2024 found that the majority of study and control group were married.

As regards the level of education, one third of the study group and control group were primary education. This support with **Mohammed et al., 2023,** who revealed that about one third of both study and control groups were illiterate. This does not agree with **Bakr, 2018**, who found that more than two thirds of the study group and half of the control group had moderate educational level.

As regards occupational status, less than one third of the study group and one third of the control group were employed. **Hanafy & El-Sayed 2023,** found that more than one third of the study sample were workers.

As regards residence, one half of the study group and more than one half of the control group were from urban areas with no statistically significant difference between study and control groups. This is in the same line with **Lachance et al., 2023,** who observed that fifty percent of the study group and fifty-six percent of the control group resided in urban areas, with no statistically significant difference.

Regarding the clinical data of patients studied, the present study clarifies that there was a statistically significant difference between study and control groups as regards diastolic blood pressure. Three fifths of study group and less than one half of the control group need blood transfusion. More than three fifths of study group and control group their diagnosis were fractures. **Zang et al., 2024** identified total hip replacement, longer surgery time, and fracture diagnosis among key predictors for perioperative transfusion.

The present study found that the majority of study groups and control groups had less than 3 hours in the operation. **Jenkins and Aaron., 2023,** found that three fifths of the study and control groups stayed in surgery for less than 3 hours.

The study revealed statistically significant intergroup differences in standing diastolic blood pressure measurements when assessed twenty-four hours postoperatively, with the study group demonstrating superior hemodynamic stability compared to controls. This early difference suggests that nursing measures such as gradual mobilization, hydration support, and continuous monitoring were effective in promoting hemodynamic stability immediately after surgery.

While after two weeks after the operation, there was a statistically significant difference between group differences exclusively in seated blood pressure measurements, with no significant variations observed in standing or supine positions, with no statistically significant difference for pulse during**.** This may suggest that while the interventions positively influenced vascular tone and venous return (reflected in blood pressure changes), they did not substantially impact autonomic heart rate responses.

Gamaa et al., 2021 demonstrated that nursing interventions (hydration bolus, physical counter-maneuvers, leg exercises) produce significant increases in standing BP and improvements in OH symptoms. This

does not agree with **Livesay and Peyton., 2021** confirmed that most postoperative patients had lower blood pressure than preoperatively, indicating that all patients are at risk for orthostatic hypotension, which Suggested that even well-designed nursing protocols may not significantly reduce hypotension .

Hanafy & El-Sayed, (2023) As well, the current study finding showed a statistically significant difference between the study and control groups post intervention related to heart rate, systolic and diastolic blood pressure. They revealed no statistically significant difference between the study and the control group regarding lying position. While highly statistically significant differences were found among them regarding the heart rate in the standing position for three minutes, especially in the second day. It was also found that there were highly statistically significant differences in systolic and diastolic blood pressure after three minutes in the third day post intervention.

This could be interpreted as even though the standing position causes a gravitational displacement of blood from the thorax to the venous vascular beds of the legs, buttock and abdomen, known as venous pooling resulting in a decrease in cardiac output (CO) and arterial pressure (AP).

The present study found that before implementing nursing measures the risk for fall was equal between two groups of patients (study and control) groups, where the majority of study and control groups had high risk for falling with no statistically significant difference between two groups. This suggests that both groups were initially homogeneous in terms of fall risk, providing a reliable baseline for comparing the effect of nursing measures. While after implementing nursing measures, more than two fifths of study group had moderate risk for falling while about two thirds of control group had a high risk for falling with statistically significant difference.

Yusuf et al., 2025 reported a seventy percent in-hospital fall rate among short-stay patients, particularly impacting THR recipients due to: postoperative mobility restrictions, altered gait mechanics, and preexisting joint dysfunction. These findings highlight the need for continuous fall prevention throughout the perioperative period.

The present study demonstrates that there was a statistically significant difference between both groups regarding the orthostatic symptoms after the implementing the nursing measures, which means the strategies are effective in reducing orthostatic symptoms.

Our results corroborate **Sun et al., 2024** finding showing significant reductions in OH symptoms after targeted nursing interventions. Both studies demonstrate that structured measures (positional training, compression therapy, counterpressure maneuvers) produce rapid, clinically meaningful symptom relief ($p < 0.01$). This cross-validation confirms the reproducibility of non-pharmacological OH management in acute postoperative care."

This finding is also supported by **Mitro et al., 2019** who reported that the effects of the leg maneuver program are explained by ending the vicious cycle that keeps the vasovagal reflex active and demonstrating that an antigravity exercise could stop a potential vasovagal faint.

From the researcher's viewpoint, improving hemodynamic parameters (heart rate, systolic and diastolic blood pressure) after nursing measures among the study group postoperatively will consequently lead to improvement in the related symptoms of orthostatic hypotension as a result of increased venous return and cardiac output.

Post-THR orthostatic hypotension stems from three key mechanisms: perioperative hypovolemia (blood loss/fluid shifts), preexisting patient factors (frailty/comorbidities), and SIRS-induced vasodilation (elevated IL-6/CRP). This triad explains the high OH incidence in THR patients, where surgical trauma combines with hemodynamic instability and endothelial dysfunction to impair early mobilization tolerance (**Donald et al., 2019).**

The present study illustrated that there is a statistically significant positive correlation between the risk of falling and symptoms of orthostatic hypotension, particularly fatigue and lightheadedness in the study group two weeks post-surgery. Additionally, a stronger correlation was observed in the control group one day after surgery. These findings suggest that patients experiencing orthostatic symptoms (e.g., dizziness, fatigue) are at a higher risk of falls, especially in the early postoperative phase. A study by **Smith et al., 2023** found that orthostatic symptoms, such as dizziness and fatigue, significantly increase fall risk in post-hip replacement patients due to impaired balance and delayed hemodynamic adjustment. Their results align with our findings, reinforcing the need for early intervention in high-risk patients.

However, **Johnson et al., 2022** argued that orthostatic symptoms do not uniformly predict fall risk, as individual factors (e.g., age, mobility, comorbidities) play a moderating role. Their study reported Studies where patients with orthostatic hypotension did not experience falls due to compensatory mechanisms like slower posture changes. The stronger correlation in the control group (one day) versus the study group (two weeks) may reflect the effectiveness of nursing measures (e.g., gradual mobilization, hydration protocols) applied to the study group, reducing symptom severity and risk of fall overtime.

The present study demonstrates that there was a statistically significant difference between the risk of falling and age before and after the implementation of the interventions among case groups, which indicate with increasing the age increase risk of falling.

Quigley et al., 2025 found that older patients and those in long-term care settings remain at significantly higher risk for anticipated physiological falls, particularly due to age-related dysautonomia, polypharmacy, and frailty-related gait instability. These

findings align with earlier research but now incorporate advanced predictive models using wearable technology to stratify fall risk in real-world clinical settings **(lee et al., 2025** and **Delbaere, 2025).**

This may be related to most patients post total hip replacement surgery are relatively elderly and had age-related neuromuscular changes and degenerative joint deformity which may compromise balance and functional ability, which increasing the propensity to fall (**Lo et al., 2019)**.

Conclusion:

The implemented nursing measures demonstrated statistically significant improvements across three key outcomes for total hip replacement patients: enhanced orthostatic hemodynamic stability (evidenced by improved vital sign measurements during positional changes), reduced OH symptom burden, and decreased fall risk during early mobilization. Compared to controls, the intervention group showed superior performance in safe bed-transition techniques, including proper anti-embolism stocking application and graded leg movement exercises, resulting in maintained blood pressure stability (≤20 mmHg systolic drop) and pulse consistency (≤30 bpm increase) during upright transitions.

Recommendations

Based on the findings of the current study, it is recommended that:

- All patients undergoing total hip replacement, particularly those at risk for orthostatic hypotension, should follow preoperative nursing measures that include instructions supported by an illustrative guide.
- Replication of this study in multicenter trials with broader participant demographics.
- Explore technology-based solutions (e.g., wearable BP monitors) for real-time orthostatic hypotension detection.
- Virtual reality (VR) training modules to practice symptom recognition and response pre-discharge.

References:

Agency for Healthcare Research and Quality. (2013). Preventing Falls in Hospitals (Tool 3F: Orthostatic Vital Sign Measurement). Availableat:https://www.ahrq.gov/professionals/systems/hospital/fallpxtoolkit/fallpxtk-tool3f. Retrieved: 10 January 2024.

American Heart Association, (2023). https://www.heart.org/en/health topics/high-blood pressure/understanding blood-pressure-readings.

Assiut University Admission Office Census, 2022.

Bakr Z.H., (2018): Effect of Educational Program on Quality of Life for Patients Post Hip Joint Replacement, Original Article *Egyptian Journal of Health Care, 2018 EJHC Vol.9 No.*3

Brailsford, B., East, E. J., Clayton, J., & Sathyanarayanan, A. (2025). Orthostatic Hypotension—An Approach to Work Up and Management. *British Journal of Hospital Medicine*, *86*(5), 1-9.

Criado, J. R., & Kalafut, M. A. (2024). Physiological Targets for Orthostatic Hypotension:

Improving Nonpharmacological Interventions in Patients with Orthostatic Cerebral Hypoperfusion. *Applied Psychophysiology and Biofeedback*, 1-11.

Delbaere, K. (2025). A smarter approach to fall prevention: insights for action. *Age and Ageing*, *54*(3), afae291.

D'Ermo, A., Di Libero, T., Langiano, E., Tosti, B., Corrado, S., Diotaiuti, P., ... & Rodio, A. (2024). Exergames in neurocognitive disease management in elderly: A narrative review of therapeutic benefits and applications. *Journal of gerontology and geriatric*, *72*, 204-214.

Donald N., Eniola G. and Deierl K., (2024): Postoperative hypotension following acute hip fracture surgery is a predictor of 30-day mortality, a prospective observational cohort analysis, The Bone & Joint Journal, Volume 106-B No.2 | Pages 189 – 194. https://doi.org/10.1302/0301-620X.106B2.BJJ-2023-0692.R2.

Fawzy Hanafy, N., & M El-Sayed, Z. (2023). Effect of Leg Maneuver Exercises on Orthostatic Hypotension among Postoperative Patients. *Egyptian Journal of Health Care*, *14*(4), 1016-1030.

Figueroa, D., Moya, L., Arteaga, J., Vaisman, A., Bostrom, M., Acuña, C.,... & Winkler, T. (2025). Orthopedic Residency Programs: What are Our Current Goals? An International Society of Orthopedic Centers (ISOC) Delphi Consensus. *HSS Journal®*, 15563316251337359.

Gamaa, A. R., Ibrahim, N. A. E. F., & Abdelaziz, T. M. (2021). Effect of Nursing Interventions on the Severity of Orthostatic Hypotension among Older Adults Residing in Assisted Living Facilities. *Alexandria Scientific Nursing Journal*, *23*(1), 18-25.

Hanafy N. F. & El-Sayed Z. M., (2023): Effect of Leg Maneuver Exercises on Orthostatic Hypotension among Postoperative Patients, *Egyptian Journal of Health Care*, December 2023 EJHC Vol. 14. No.4

Hogan, A. M., Luck, C., Woods, S., Ortu, A., & Petkov, S. (2021). The Effect of Orthostatic Hypotension Detected Pre-Operatively on Post-Operative Outcome. *Journal of the American Geriatrics Society*, *69*(3), 767-772.

Hristovska, A. M., Uldall-Hansen, B., Mehlsen, J., Andersen, L. B., Kehlet, H., & Foss, N. B. (2023). Orthostatic intolerance after acute mild hypovolemia: incidence, pathophysiologic hemodynamics, and heart-rate variability analysis—a prospective observational cohort study. *Canadian Journal of Anesthesia*/, *70*(10), 1587-1599.

Jenkins, D. R., & Aaron, R. K. (2023). The effect of surgical duration on complications and patient reported outcomes in total hip replacement as evaluated through multi-surgeon pooled FORCE registry data from a tertiary care referral total joint center. *Rhode Island Medical Journal*, *106*(7), 37-42.

Johnson, B., Wilson, D., & Miller, F. (2022). Variability in fall risk among patients with orthostatic hypotension. *Geriatric Medicine*, *10*(3), 78-85.

Jordan, J., Biaggioni, I., Kotsis, V., Nilsson, P., Grassi, G., Fedorowski, A., & Kario, K. (2023). Consensus statement on the definition of orthostatic hypertension endorsed by the American Autonomic Society and the Japanese Society of Hypertension. *Clinical Autonomic Research*, *33*(1), 69-73.

Lachance, A. D., Call, C., Radford, Z., Stoddard, H., Sturgeon, C., Babikian, G., ... & McGrory, B. J. (2023). Rural-urban differences in hospital and patient-reported outcomes following total hip arthroplasty. *Arthroplasty today*, *23*, 101190.

Lee, S., Park, E., Canelo, A., Park, H., Kim, Y., Chun, H., ... & Li, Z. (2025). NTIRE 2025 challenge on efficient burst her and restoration: Datasets, methods, and results. In *Proceedings of the Computer Vision and Pattern Recognition Conference* (pp. 1002-1017).

Livesay, T., & Peyton, K. (2021). Reducing Symptomatic Postoperative Hypotension in the Extended Stay Patient. *Journal of PeriAnesthesia Nursing*, *36*(4), e22.

LoC.W. , Tsang W.W., Yan C.H., Lord S.R., Hill K.D. and Wong A.Y., (2019): Risk factors for falls in patients with total hip arthroplasty and total knee arthroplasty: a systematic review and meta-analysis, Osteoarthritis and Cartilage, *27*(7), 979-993.

Mitro, P., Muller, E., and Lazurova, Z. (2019). Hemodynamic differences in isometric counter-pressure maneuvers and their efficacy in vasovagal syncope. *International Journal of Arrhythmia*, *20*(4), 1-10.

Mohammed H.S., Shehata A.E., Fareed M.E., and El-Sayad H.E., (2023): Effect of Pre and Postoperative Nursing Intervention on Activities of Daily Living and Quality of life among Patients undergoing Hip Replacement, *Menoufia Nursing Journal*, *8*(1), 20-6.

Morse, J. M., Morse, R. M., & Tylko, S. J. (1989). Development of a scale to identify the fall-prone patient. *Canadian Journal on Aging, 8*(4), 366–377. https://doi.org/10.1017/S0714980800008576

Palma, J. A., & Kaufmann, H. (2024). Pharmacologic Treatment for High BP and Risk of CVD. *JAMA*, *331*(6), 530-531.

Quigley, B. L., Wellington, N., Levenstein, J. M., Dutton, M., Bouças, A. P., Forsyth, G., ... & Hermens, D. F. (2025). Circulating biomarkers and neuroanatomical brain structures differ in older adults with and without post-traumatic stress disorder. *Scientific Reports*, *15*(1), 7176.

Reilly, L. (2024). Orthostatic Vital Signs to Reduce Falls on the Inpatient BMT Units. *Transplantation and Cellular Therapy*, *30*(2), S72.

Rivasi, G., Kenny, R. A., Ungar, A., & Romero-Ortuno, R. (2020). Predictors of the incident fear falling into community-dwelling older adults. *Journal of the American Medical Directors Association*, *21*(5), 615-620.

Sarnaik, K. S., & Mirzai, S. (2025). Review of Blood Pressure Control in Vulnerable Older Adults: The Role of Frailty and Sarcopenia. *Journal of Vascular Diseases*, *4*(2), 18.

Schrezenmaier, C., Gehrking, J. A., Hines, S. M., Low, P. A., Benrud-Larson, L. M., & Sandroni, P. (2005, March). Evaluation of orthostatic hypotension: relationship of a new self-report instrument to laboratory-based measures. In *Mayo Clinic Proceedings*, *80*(3), 330-334. Elsevier.

Smith, A., Brown, C., & Davis, E. (2023). Orthostatic symptoms and fall risk in post-hip replacement patients. Journal of Clinical Orthopedics, 15(2), 45-52.

Smits M , Lin S , Rahme J , Bailey M , Bellomo R , Hardidge A . (2019). Blood pressure and early mobilization after total hip and knee replacements. *JBJS Open Access*; *4*(2): e0048. Crossref Pub Med Google Scholar

Strumia, M., Vidal, J. S., Cestac, P., Sallerin, B., Hanon, O., Rouch, L.,…& Danchin, N. (2023). Orthostatic hypotension and orthostatic hypertension are both associated with lower cognitive function: The S. AGES cohort. *Journal of the American Geriatrics Society*, *71*(12), 3721-3730.

Sun, J., Xu, Y., Zhu, J., Zhu, B., & Gao, W. (2024). Efficacy and safety of continuous nursing in improving functional recovery after total hip or knee arthroplasty in older adults: A systematic review. *International Journal of Nursing Sciences*.

Wahba, A., Shibao, C. A., Muldowney, J. A., Peltier, A., Habermann , R., & Biaggioni, I. (2022). Management of orthostatic hypotension in the hospitalized patient: a narrative review. *The American Journal of Medicine*, *135*(1), 24-31.

Yusuf, Y., Noor, A., Ebrahim, M., Farah, N., & Zainab, A. (2025). Improving Orthostatic Hypotension Screening in Fall Prevention: A Two-Cycle Audit on Falls Assessment and Lying and Standing Blood Pressure Measurement. *Cureus*, *17*(3).

Zang, H., Hu, A., Xu, X., Ren, H., & Xu, L. (2024). Development of machine learning models to predict perioperative blood transfusion in hip surgery. *BMC Medical Informatics and Decision Making*, *24*(1), 158.