

## Post-Thrombotic Syndrome: Effect of Nurse-Led Interventions on Patients' Clinical Severity, Quality of Life, and Disease Recurrence.

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### Abstract

**Background:** Post-thrombotic syndrome (PTS) is a chronic and debilitating complication of deep vein thrombosis (DVT), affecting 20–50% of patients globally. It significantly impairs quality of life (QoL) and substantially burdens healthcare systems. This study aimed to evaluate the Effect of Nurse-Led Interventions on clinical severity, quality of life (QoL), and disease recurrence among patients with PTS. **Methods:** A quasi-experimental design was used, with 60 PTS patients randomly assigned to either a control or an intervention group. The study was conducted at the vascular surgery department and its outpatient clinics at Assiut University Hospital, Egypt. Outcomes were assessed using Tool I:- Interview questionnaire sheet (Demographic characteristics, Risk factors assessment, and the Venous Clinical Severity Score), Tool II: Chronic Venous Insufficiency Quality of Life Questionnaire (CIVIQ-20), and Tool III: DASH ( D- dimer, Age, Sex, and Hormone use) score for recurrent VTE (venous thromboembolism). **Results:** After three months, the intervention group showed significant improvements compared to the control group. Venous Clinical Severity Score (VCSS) scores revealed reduced symptom severity, including pain, edema, skin pigmentation, and ulceration ( $p < 0.001$ ). CIVIQ-20 scores demonstrated marked enhancement in all QoL domains, particularly psychological distress (over 60% reduction,  $p < 0.001$ ). Additionally, 73.3% of the intervention group was reclassified as low risk by the DASH score versus 23.3% in the control group ( $p < 0.001$ ). Strong correlations were found between lower clinical severity, improved QoL, and reduced recurrence risk among the intervention group. **Conclusion:** Reductions in symptom severity, marked improvements in QoL domains, and favorable shifts in VTE recurrence risk highlight the effectiveness of comprehensive Nurse-Led Interventions in PTS management. These findings underscore the critical role of integrated, structured interventions in optimizing long-term outcomes for DVT survivors. **Recommendation:** Nurse-led interventions should be integrated into routine care for patients with post-thrombotic syndrome (PTS).

**Keywords:** Post-thrombotic syndrome, Nurse-Led Interventions, Quality of life, Clinical Severity, Disease recurrence

### Introduction

Post-thrombotic syndrome (PTS) is a debilitating complication of deep vein thrombosis (DVT), affecting approximately 20–50% of individuals who experience DVT, depending on the severity of the initial clot and its location within the venous system (Kahn et al., 2014)

This chronic condition arises due to structural damage to the veins and valves caused by DVT, leading to impaired venous return, venous hypertension, and subsequent clinical manifestations. Symptoms include persistent leg pain, swelling, heaviness, skin discoloration, and in severe cases, venous ulcers, which significantly impair quality of life (QoL) and impose substantial economic burdens on healthcare systems globally (Rathbun & Kalodiki, 2018).

Some studies report an incidence of 20% to 50% in patients with a history of DVT (Ariyanti, et al; 2023). Approximately 8% to 10% of cases are severe,

significantly reducing the quality of life of affected individuals (Prandoni, et al; 2024). A systematic review of 16 cohort studies found variation in occurrence rates across different countries, with an overall 2-year incidence of PTS at 37.5% (Yu et al; 2024).

The global prevalence of PTS underscores its significance as a public health issue. According to recent estimates, PTS contributes to approximately \$7.8 billion in annual healthcare costs in the United States alone, with similar financial impacts observed in other high-income countries (Santos et al., 2023). Moreover, the psychosocial burden of PTS cannot be overlooked, as patients often experience anxiety, depression, and social withdrawal due to visible symptoms and functional limitations (Godiya et al., 2025).

These challenges necessitate a multifaceted management approach that addresses the condition's physical and psychological aspects. Despite advances in

anticoagulation therapy and early intervention strategies for DVT, the prevention and management of PTS remain suboptimal. A systematic review by **Kahn et al. (2021)** highlighted the need for improved patient education, adherence to compression therapy, and lifestyle modifications to mitigate symptom progression and recurrence risk. In this context, nurse-led interventions emerge as a critical component of comprehensive care for individuals with PTS. Nurses, with their unique expertise in patient-centered care, are well-positioned to bridge gaps in knowledge, provide ongoing support, and implement evidence-based practices to optimize outcomes.

### **Significance of the study:**

The post-thrombotic syndrome (PTS) is a common and potentially debilitating complication of deep vein thrombosis (DVT), affecting up to 50% of DVT patients (**Prandoni et al., 2024**). Statistics at Assiut University Hospital specifically in the vascular surgery department in the year 2023 revealed that the number of patients admitted to the vascular surgery department with DVT was about 120 patients. Clinical observation researcher observed those patients readmitted to hospital within 3 to 6 months with PTs following DVT complaints from primary venous insufficiency, leg pain, heaviness, fatigue, swelling, skin discoloration, lipodermatosclerosis, and venous ulcers in severe cases. Symptoms are typically exacerbated by standing or walking and can range from mild to severe. Nurses are considered to be central to health care provision and highly valued by patients, particularly in the PTs. Therefore the objective of this study is to evaluate the effect of Nurse-Led interventions on clinical severity, QoL, and recurrence risk among PTS patients.

This paper aims to explore the pivotal role of nurse-led interventions in managing PTS, focusing on strategies to alleviate clinical severity, improve QoL, and reduce recurrence. By integrating recent advancements in clinical practice, and patient engagement, nurses can lead transformative efforts to address the unmet needs of PTS patients worldwide.

### **Theoretical definition:**

**Nurse-led interventions:** are healthcare approaches where registered nurses play a primary role in designing, implementing, and overseeing various aspects of patient care and treatment. These interventions leverage the expertise, knowledge, and skills of nurses to improve patient outcomes, enhance patient engagement, and optimize resource utilization. Nurse-led interventions can occur across various healthcare settings, including hospitals, clinics, community health centers, and even in patients' homes (**Bulto et al., 2024**).

### **Researcher hypothesis:**

The patients with PTS who received nurse-led intervention expected to experience an improvement in clinical severity, QoL, and recurrence risk less than those who did not.

### **Methodology:**

#### **Patients & method**

**Study design:** A quasi-experimental (control and study) research design used to achieve the study's aim.

**Setting:** The study was conducted in the vascular surgery department and its outpatient clinics at Assiut University Hospital, Egypt.

#### **Study sample:**

A purposive sample of 60 patients was divided into two groups (intervention group and control group) of 30 patients each, who volunteered to participate in the study regardless of gender, education level, or location.

**Inclusion criteria** of the participants were adult males and females aged 20 to 65 years old, ready to engage in the study, and patients with initial injury of deep vein thrombosis in the leg.

**The exclusion criteria** of the participants were:

- Presence of severe comorbid conditions that may interfere with the study outcomes (e.g., terminal illnesses, severe renal or hepatic failure).
- Individuals with cognitive impairments or inability to provide informed consent.
- Those who have undergone major surgery within the past three months.

### **Tools of the study:**

Three tools were used to achieve the aim of the study.

#### **Tool I:- Interview questionnaire sheet.**

This tool was used to assess demographic data, risk factors, and disease severity, and included 3 parts:

**Part 1:- Demographic characteristics**, such as age, gender, residence, educational level, and occupation.

**Part 2:- Risk factors assessment:** which includes immobilization, advancing age, previous venous thromboembolism, etc.

**Part 3:- Venous Clinical Severity Scale:** Is a tool used to assess the severity of chronic venous disease based on clinical symptoms and signs that appear on a patient's leg this tool was adopted from the American Venous Forum Committee on Outcomes Assessment developed the Venous Severity Scoring system in 2000 (**Rutherford, et al, 2000**). It includes 10 parameters (i.e. pain, varicose veins, venous edema, skin pigmentation, inflammation, induration, no active ulcer, active ulcer duration, active ulcer size, and compressing therapy). Each response was scored on a four-point scale from 0

to 3 (0 = not at all, 1 = mild, 2 = moderate, and 3 = severe). Contrariwise, for the last parameter of compression, higher scores represent greater compliance. A higher total score means severe venous disease.

#### Scoring system:

- 0-3 means mild to no disease
- 4-7 means mild to moderate disease
- 8 or more means severe disease

#### **Tool II: Chronic Venous Insufficiency Quality of Life Questionnaire:**

The Chronic Venous Insufficiency Quality of Life Questionnaire (CIVIQ) is a disease-specific instrument to assess the quality of life of patients with chronic venous insufficiency adopted from (Launois et al., 2014). This 20-item questionnaire provides a global index and a profile on 4 domains QOL questionnaire including psychological (9 items), pain (4 items), physical (4 items), and social (3 items) was initially developed in French (CIVIQ-20). Items on the CIVIQ scale were scored from 1 to 5.

A low score generally indicates a better quality of life. A global (total) index score (GIS) is calculated by summing the scores of all 20 items, with a minimum score of 20 and a maximum of 100

#### **Scoring System:**

There are 20 questions in the CIVIQ-20, each with 5 possible answers (1 to 5), the minimum possible score being 20 and the maximum 100. In order to calculate the GIS, the difference between the final score and the minimum possible score is to be divided by the difference between the theoretical maximum and minimum scores (100-20=80), multiplied by 100.

- $GIS = ([\text{Final score} - \text{minimal possible score}] / [\text{Theoretical maximal} - \text{minimal score}]) \times 100$
- $GIS = ([\text{Final score} - \text{minimal possible score}] / 80) \times 100$
- $GIS = ([\text{Final score} - 20] / 80) \times 100$

#### **Example CIVIQ-20:**

The score obtained from the 20-item questionnaire: was 40.

The calculation is the following:  $40-20=20$ . This number should be divided by 80:  $20/80=0.25$ , then multiplied by 100. The GIS is 25.

In order to make GIS increase when the quality of life is improving, scores can be inverted and 25 become 75. ( $100-25=75$ ).

#### **Tool III: DASH Prediction Score for Recurrent VTE:**

The DASH score was developed by (Tosetto et al, 2012) and used to calculate the risk of recurrent venous thromboembolism (VTE) in an individual with a recent VTE event. The DASH score was developed based on individuals who had received treatment with a

Vitamin K Antagonist(VKA) [e.g. warfarin] rather than Direct-Acting Oral Anticoagulants ( DOAC).

The DASH consists of four variables (D-dimer: normal is pointed by 0, while abnormal takes 2 points; age: < 50 years is pointed by 0, while  $\leq 50$  takes 2 points; male: no is pointed by 0, while yes takes 2 points; and hormone use if female: no is pointed by 0, while yes takes 2 points).

**Scoring System:** Individuals with a DASH score of  $\leq 1$  have a low risk of annual recurrence whilst those with a DASH score of  $\geq 2$  have an increased risk of VTED and this may be an indication of indefinite anticoagulation.

#### **Validity and Reliability**

A five-person expert panel examined the teaching material (booklet) for clarity, relevance, comprehensiveness, comprehension, and ease of implementation. Three professors in the field of vascular surgery and two professors in the field of nursing served on the panel. Few modifications were needed, and the correction was made as necessary.

The Venous Clinical Severity Score (VCSS) demonstrated a reliability coefficient of 0.6, indicating moderate reliability (Meissner et al; 2002). In contrast, the CIVIQ-20 exhibited excellent internal consistency and reliability, with a Cronbach's alpha above 0.80. This high level of reliability underscores its robustness as a patient-reported outcome measure for chronic venous insufficiency, ensuring that it can consistently capture patients' perceptions of their condition across different settings (Launois et al; 2010). The DASH score, widely regarded as a practical and reliable tool for predicting recurrent venous thromboembolism (VTE) risk, further complements these tools. It demonstrates good internal consistency, strong interobserver agreement, and external validation, making it a dependable instrument for risk stratification. Although its discrimination ability is moderate, with an area under the curve (AUC) ranging from 0.65 to 0.70, its simplicity, practicality, and widespread adoption reinforce its utility in clinical practice (Tosetto et al; 2012). Together, these tools provide a comprehensive approach to evaluating venous disease severity, patient-reported outcomes, and VTE recurrence risk, each contributing unique strengths while maintaining acceptable to excellent levels of reliability.

#### **Pilot study**

Ten percent of the patients, or six patients, took part in a pilot study to evaluate the tools' clarity and the time needed to apply them. Since no changes were made, these patients were then enrolled to the study.

#### **Ethical Consideration:**

On January 29, 2023, the faculty of nursing's ethics committee approved the research request under ethical code 110230449. The head of the Assiut

University hospital's vascular surgery department and its outpatient clinics, as well as the dean of the Faculty of Nursing, formally granted authorization. The study's aims and objectives were explained to the patients prior to its commencement, and they were also made aware of their ability to withdraw from the study at any moment. The patients gave their oral consent at the beginning of the study, and their anonymity was protected.

### **Nurse-led interventions in Managing Post-Thrombotic Syndrome (PTS)**

Nurse-led interventions play a pivotal role in the management of post-thrombotic syndrome (PTS), addressing its multifaceted nature and improving patient outcomes. These interventions are designed to alleviate symptoms, enhance quality of life, reduce recurrence risks, and empower patients through education, psychosocial support, and evidence-based practices. The intervention included:

#### **1. Patient Education and Empowerment:**

**Objective:** Equip patients with knowledge about PTS, its causes, progression, and management strategies to promote self-efficacy and adherence to treatment plans.

##### **Approach :**

- Provide structured educational sessions on PTS, including information about venous anatomy, the impact of DVT, and potential long-term complications.
- Teach patients how to recognize early signs of symptom exacerbation or recurrence of venous thromboembolism (VTE).
- Explain the importance of adhering to prescribed treatments, such as compression therapy and anticoagulation medication.
- Use visual aids, brochures, and digital resources to enhance understanding and retention of information.

#### **2. Compression Therapy Management:**

**Objective:** Optimize the use of graduated compression stockings to reduce edema, improve venous return, and alleviate symptoms.

##### **Approach :**

- Assess patients for appropriate stocking type, pressure grade, and size based on individual needs and clinical guidelines.
- Demonstrate proper fitting techniques and provide hands-on training for donning and doffing stockings.
- Educate patients on the maintenance and care of compression garments to ensure longevity and effectiveness.
- Schedule regular follow-ups to monitor compliance, assess skin integrity, and adjust stocking prescriptions as needed.

#### **3. Lifestyle Modifications and Health Promotion:**

**Objective:** Encourage healthy behaviors that mitigate symptoms and reduce the risk of VTE recurrence.

##### **Approach:**

- Promote physical activity tailored to the patient's abilities, such as walking, or low-impact exercises, to enhance venous circulation.
- Advise on weight management strategies, emphasizing balanced nutrition and portion control, particularly for overweight or obese patients.
- Encourage adequate hydration and a fiber-rich diet to prevent constipation, which can exacerbate venous pressure.
- Discuss the importance of avoiding prolonged immobility and adopting good posture during sitting or standing.

#### **4. Pain Management**

**Objective:** Develop personalized pain management plans to address chronic discomfort associated with PTS.

##### **Approach :**

- Collaborate with healthcare teams to evaluate the underlying causes of pain and identify appropriate pharmacological options, such as nonsteroidal anti-inflammatory drugs (NSAIDs) or opioids if necessary.
- Introduce non-pharmacological approaches, including heat/cold therapy, massage, and gentle stretching exercises.
- Incorporate mindfulness techniques, relaxation exercises, and cognitive-behavioral strategies to help patients cope with chronic pain.

#### **5. Psychosocial Support:**

**Objective:** Address the emotional and psychological impact of PTS to improve mental well-being and social engagement.

##### **Approach :**

- Conduct regular assessments of mental health using validated tools to screen for anxiety, depression, or other mood disorders.
- Provide empathetic listening and counseling to validate patient experiences and build trust.
- Facilitate connections with peer support groups or online communities where patients can share their challenges and successes by providing them with the addresses and phone numbers of rehabilitation centers that offer services following deep venous thrombosis.
- Refer patients to mental health professionals when specialized interventions are required.

## 6. Recurrence Prevention:

**Objective:** Minimize the risk of recurrent VTE through proactive monitoring and preventive measures.

### Approach :

- Reinforce the importance of continued anticoagulation therapy, ensuring patients understand dosage regimens and potential side effects.
- Screen for modifiable risk factors, such as smoking, obesity, sedentary lifestyle, and genetic predispositions, and develop targeted interventions.
- Educate patients on recognizing warning signs of recurrent VTE and seeking immediate medical attention.

## 7. Monitoring and Evaluation

**Objective:** Continuously assess the effectiveness of nurse-led interventions and make data-driven improvements.

### Approach :

- Use standardized outcome measures, such as the Venous Clinical Severity Score (VCSS), to quantify symptom severity and track progress over time.
- Analyze patient-reported outcomes to identify patients' improvement.
- Assess Quality of Life (QoL): Utilize condition-specific and general health-related quality of life instruments (e.g., CIVIQ-20 – Chronic Venous Insufficiency Quality of Life Questionnaire) to measure the physical, emotional, and social impact of venous disease and its treatment.
- Monitor Disease Recurrence: Track long-term outcomes by documenting instances of disease recurrence post-treatment using the DASH Score.

## Fieldwork

### Phase 1: Assessment Phase

- To conduct the study, official approval was obtained from the head of the Vascular Surgery department, at Assiut University Hospitals. DVT patients were assured of confidentiality and provided informed consent after understanding the study's purpose.
- A colorful Arabic educational booklet on DVT was prepared, printed, and distributed to all participants, with a 100% agreement rate.

### Phase 2: Intervention Phase

- Researchers introduce themselves to the intervention and control groups of patients during the initial meeting, which lasts 15–20 minutes.

- Identify eligible participants based on inclusion/exclusion criteria.
- Randomly assign participants to either the control group or the intervention group.
- Collect the necessary data from participants including demographics, risk factors, venous clinical severity, chronic venous insufficiency quality of life, and DASH Prediction Score for Recurrent VTE from both studied groups.
- Implement and monitor the nurse-led interventions for the intervention group while providing standard care to the control group over three months.
- Control Group (Standard Care): Provide nursing intervention according to clinical guidelines. Conduct routine medical follow-ups every three months. Offer general advice on lifestyle modifications and anticoagulation therapy.
- Intervention Group (Nurse-Led Interventions): To effectively manage post-thrombotic syndrome (PTS), a comprehensive approach involving patient education, compression therapy management: lifestyle modifications and health promotion, pain management, psychosocial support, and recurrence prevention is essential. Structured educational sessions are delivered to equip patients with the knowledge and skills necessary for PTS management, including training on the proper fitting and use of graduated compression stockings (GCS). Personalized exercise plans are developed to encourage healthy lifestyle modifications, with advice provided on avoiding prolonged immobility to further mitigate symptoms. Pain management strategies incorporate non-pharmacological techniques such as heat/cold therapy and massage, alongside collaboration with physicians for pharmacological interventions when necessary.
- To prevent recurrence, adherence to anticoagulation therapy is reinforced, and modifiable risk factors are screened for and addressed with targeted interventions. Telehealth integration plays a critical role in this framework, utilizing mobile calls for symptom tracking and reminders. Throughout the process, regular monitoring ensures detailed documentation of adherence, side effects, and adverse events, providing a clear record of intervention delivery and participant progress. This holistic approach aims to empower patients, improve outcomes, and enhance overall quality of life.

## Educational Sessions:

Each session took about 30 min. The study was conducted in the morning and afternoon shifts. The sessions were given on an individual basis. During the

session one of the family members was present to ensure patient support and take care of their patients during application of the program at home.

- **The First session:** covered the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> parts of nurse led intervention patient education and empowerment, compression therapy management, lifestyle modifications and health promotion,).
- **The Second session** covered the 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, and 7<sup>th</sup> parts of nurse led interventions (pain management, psychosocial support, recurrence prevention, and monitoring and evaluation).
- At the end of each session, feedback was received from the patients to assess their understanding, and then the researchers explained any difficult points.
- Each patient was given a copy of the booklet in clear Arabic language, to help them retain the learned material.

- The program was carried out for 4 months for the study group only while the control group received routine hospital care during the time of discharge which included giving the patients a follow-up card by a member of the nursing team for follow-up in outpatient clinics every two weeks and give them a list of prescribed medications to take during the recovery period.
- Data was collected through the period from the beginning of March 2023 to the end of April 2024.

### Phase 3: Evaluation Phase:

To evaluate the outcomes of the study by comparing changes in clinical severity, quality of life, and recurrence risk between the control and intervention groups after three months by using tool I part 3, tool II, tool III

## Results:

**Table (1): Distribution of post-thrombotic patients (Intervention and control groups) concerning demographic data (N=60):**

Demographic data	intervention Group		Control Group		F-test	P-value
	N	%	N	%		
<b>Age:</b>						
20 to < 30	6	20.0	5	16.7	0.209	0.649
30 to < 45	11	36.7	9	30.0		
45 to 64	13	43.3	16	53.3		
<b>Mean ± SD</b>	<b>40.4±11.1</b>		<b>43.8±11.2</b>			
<b>Gender:</b>						
Male	22	73.3	21	70	0.318	0.575
Female	8	26.7	9	30		
<b>Level of education:</b>						
Illiterate	2	6.7	7	23.3	1.184	0.196
Read and write	8	26.7	3	10.1		
Secondary education	9	30.0	10	33.3		
University education	11	36.6	10	33.3		
<b>Occupation:</b>						
Employee	8	26.7	9	30	1.855	0.196
Farmer	4	13.3	5	16.7		
Professional	3	10.0	9	30		
Housewife	5	16.7	2	6.7		
Doesn't work	10	33.3	5	16.7		
<b>Marital status:</b>						
Single	4	13.3	4	13.3	0.334	0.566
Married	21	70.0	23	76.7		
Widow	5	16.7	3	10.0		
<b>Residence:</b>						
Rural	6	20.0	9	30.0	1.180	0.180
Urban	24	80.0	21	70.0		

Independent sample T-test

\* Statistical significant differences ( $p < 0.05$ )

**Table (1): reflects that;** The mean ages of post-thrombotic patients (intervention and control group) were between  $40.4 \pm 11.1$  and  $43.8 \pm 11.2$ , respectively. Two-thirds of the patients were male, while one-third were highly educated and held university degrees. One-third of the post-thrombotic (intervention group) did not work, and one-third of the control group consisted of employees and professionals. As for marital status, more than two-thirds of the studied sample was married. The majority of the participants in the intervention group lived in urban areas; additionally, more than two-thirds of the control group also lived in urban areas.

**Table (2): Distribution of risk factors for post-thrombotic syndrome among the studied sample (N=60):**

Risk factors	Intervention Group		Control Group		F-test	P-value
	N	%	N	%		
Advancing age:	13	43.3	16	53.3	1.648	0.204
Obesity	8	26.7	9	30.0	0.318	0.575
Major trauma (including fracture)	25	83.3	28	93.3	3.286	0.115
Active cancer	1	3.3	0	0.0	2.291	0.143
Acute medical illness	24	80.0	27	90.0	2.934	0.130
Paralytic Stroke	0	0.0	1	3.3	2.291	0.143
immobilization	30	100.0	28	93.3	1.609	0.113
Oral contraceptives	4	13.3	8	26.7	3.089	0.110
Ant phospholipid syndrome	12	40.0	15	50.0	1.208	0.276
Inherited thrombophilias	3	10.0	4	13.3	0.633	0.430
Previous venous thromboembolism	30	100.0	27	90.0	2.312	0.112
Congenital venous malformation	29	96.7	26	86.7	2.930	0.114
Varicose vein	25	83.3	27	90.0	2.323	0.133
Long distance travel	14	46.7	18	60.0	0.856	0.359
Pregnancy \ antepartum	3	10.0	5	16.7	2.323	0.133
Hormonal replacement therapy	4	13.3	7	23.3	2.117	0.147

Independent sample T-test

\* Statistical significant differences ( $p < 0.05$ )

**This table shows that;** The vast majority of the studied group of patients had the risk factors for developing post-thrombotic syndrome were immobilization (100%, 93.3%) and previous venous thromboembolism (100%, 90%), respectively, followed by congenital venous malformation (96.7% and 86.7%), varicose veins (83.3% and 90%), and acute medical illness (80% and 90%).

**Table (3): Relation between studied groups pre- and post-3 months of Nurse-Led Intervention related to the mean of patients' Venous Clinical Severity Scale (No = 60):**

Venous Clinical Severity Scale	Intervention Group (N=30)		Control Group (N=30)		P-value1	P-value2
	Pre	Post 3 months	Pre	Post 3 months		
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD		
Pain	2.56 $\pm$ 0.50	0.63 $\pm$ 0.49	2.66 $\pm$ 0.47	2.60 $\pm$ 0.49	0.146	0.001 ***
Varicose veins	2.56 $\pm$ 0.50	0.56 $\pm$ 0.50	2.60 $\pm$ 0.49	2.56 $\pm$ 0.50	0.615	0.001 ***
Venous edema	2.63 $\pm$ 0.49	0.63 $\pm$ 0.49	2.60 $\pm$ 0.49	2.60 $\pm$ 0.49	0.606	0.001 ***
Skin pigmentation	2.56 $\pm$ 0.50	0.53 $\pm$ 0.50	2.66 $\pm$ 0.47	2.63 $\pm$ 0.49	0.146	0.001 ***
Inflammation	2.60 $\pm$ 0.49	0.53 $\pm$ 0.50	2.70 $\pm$ 0.46	2.60 $\pm$ 0.49	0.125	0.001 ***
Induration	2.60 $\pm$ 0.49	0.60 $\pm$ 0.49	2.53 $\pm$ 0.50	2.53 $\pm$ 0.50	0.359	0.001 ***
No active ulcer	2.56 $\pm$ 0.50	0.60 $\pm$ 0.49	2.60 $\pm$ 0.49	2.60 $\pm$ 0.49	0.615	0.001 ***
Active ulcer duration	2.70 $\pm$ 0.47	0.60 $\pm$ 0.49	2.56 $\pm$ 0.50	2.60 $\pm$ 0.49	0.154	0.001 ***
Active ulcer size	2.66 $\pm$ 0.49	0.63 $\pm$ 0.49	2.53 $\pm$ 0.50	2.56 $\pm$ 0.50	0.179	0.001 ***
Compressive therapy	2.63 $\pm$ 0.49	0.63 $\pm$ 0.49	2.60 $\pm$ 0.49	2.60 $\pm$ 0.49	0.606	0.001 ***

Independent sample T-test

\* Statistical significant differences ( $p < 0.05$ )

**P-value1:** relation between pre-intervention group & pre-control group

**P-value2:** relation between post 3-months intervention group & post 3-months control group

**This table shows that:** Post Nurse-Led- Intervention there was a statistically significant improvement in the mean of the venous clinical severity among the intervention group of patients compared to the control group of patients related to skin pigmentation, pain, venous edema, inflammation, no of active ulcers, active ulcer duration, and compressive therapy(2.63 $\pm$ 0.49, 2.60 $\pm$ 0.49, 2.60 $\pm$ 0.49, 2.60 $\pm$ 0.49, 2.60 $\pm$ 0.49, 2.60 $\pm$ 0.49, and 2.60 $\pm$ 0.49) respectively. However, there were no statistically significant differences between the intervention and the control group concerning the venous clinical severity per implementing nurse-led- intervention.

**Table (4): Relation between studied groups pre- and post-3 months of Nurse Led-Intervention related to the mean of four domains Quality of life(No = 60):**

Four domains Quality of life	Intervention Groups (N=30)		Control Groups (N=30)		P-value1	P-value2
	Pre	Post 3 months	Pre	Post 3 months		
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD		
Psychological	39.0 $\pm$ 3.2	14.4 $\pm$ 2.5	39.2 $\pm$ 2.8	38.1 $\pm$ 2.6	0.736	0.001 ***
Pain	17.4 $\pm$ 1.6	7.7 $\pm$ 1.3	17.3 $\pm$ 1.4	15.7 $\pm$ 1.5	0.801	0.001 ***
Physical	17.4 $\pm$ 1.6	7.9 $\pm$ 1.2	17.8 $\pm$ 1.1	15.7 $\pm$ 1.5	0.310	0.001 ***
Social	13.1 $\pm$ 1.7	4.8 $\pm$ 1.4	13.6 $\pm$ 1.1	11.9 $\pm$ 1.7	0.262	0.001 ***

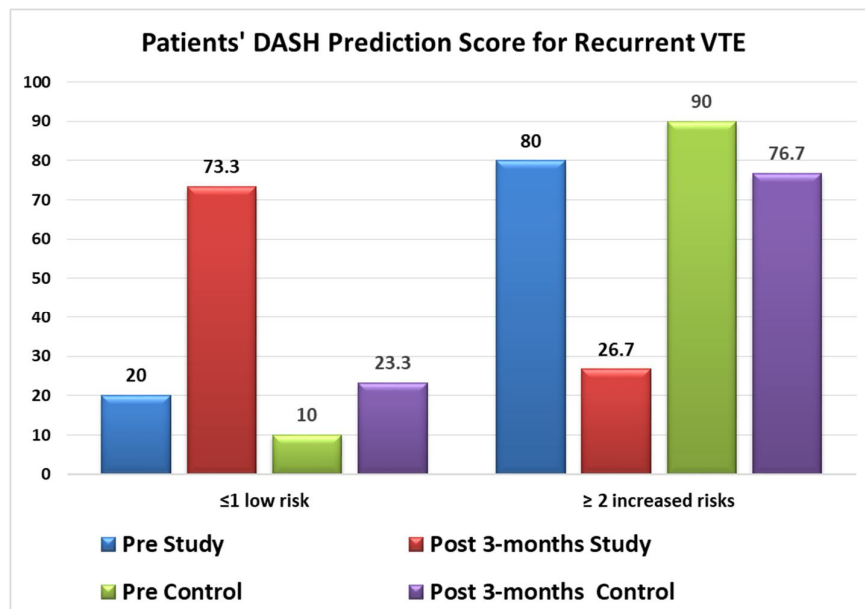
Independent sample T-test

\* Statistical significant differences ( $p < 0.05$ )

**P-value1:** relation between pre-intervention group & pre-control group

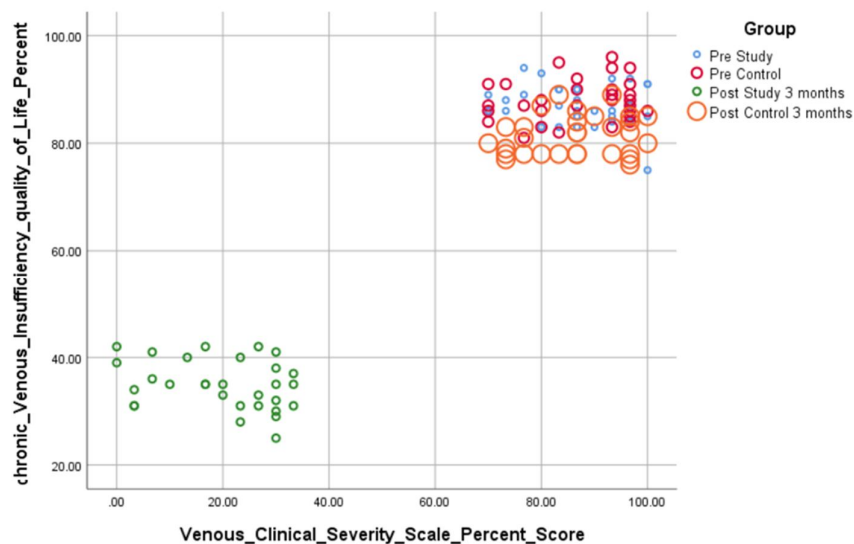
**P-value2:** relation between post 3-months intervention group & post 3-months control group

**This table clarifies that:** There were highly statistically significant differences in the standard deviation in all domains of quality of life after implementing Nurse-Led Intervention (3 months) among the intervention group compared with the control group, with a p-value of 0.001.



**Figure (1): Percentage distribution of studied groups pre- and post-3 months of Nurse Intervention related to patients' DASH Prediction Score for Recurrent VTE (No=60):**

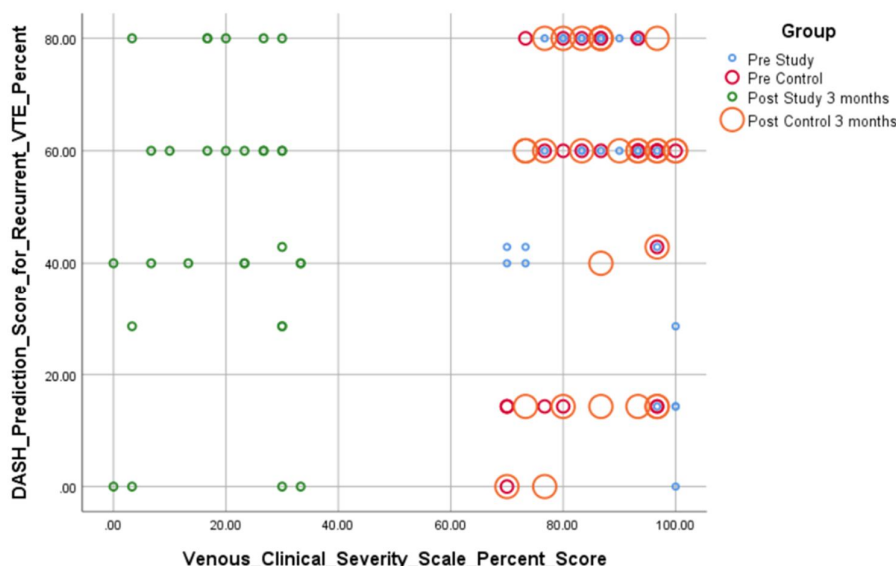
**Fig. (1):** There were no statistically significant differences between the intervention group and the control group regarding the DASH Prediction Score for Recurrent VTE per implementing the Nurse Intervention, while three months following the implementation of the Nurse Intervention, it was found that approximately 73.3% of patients in the intervention group had a low risk according to the DASH Prediction Score for Recurrent VTE, compared to the control group, where about 76.7% had two or more increased risks related to the DASH Prediction Score for Recurrent VTE.



**Figure (2): Relation between patients' Venous Clinical Severity scale and Chronic Venous Insufficiency quality of Life scale:**

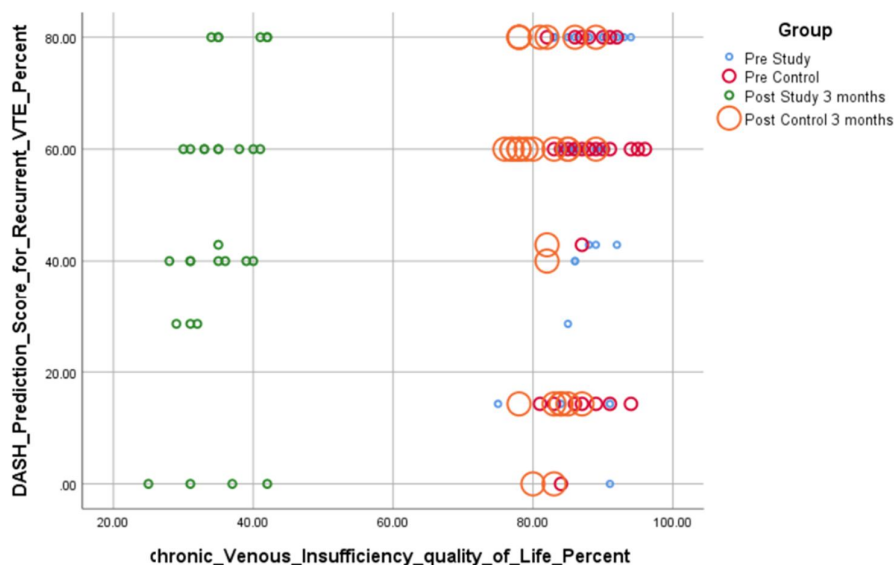
**Fig. (2):** illustrates the negative correlation between the Venous Clinical Severity scale and the Chronic Venous Insufficiency quality of Life scale which means higher VCSS scores (indicating more severe clinical manifestations) correlate with higher QoL scores (indicating worse quality of life), or vice versa.





**Figure (3): Relation between patients' Venous Clinical Severity scale and DASH Prediction Score for Recurrent VTE:**

**Fig (3):** illustrates a positive correlation between the clinical severity of PTS (VCSS) and the predicted risk of recurrent VTE (DASH score) which means higher clinical severity of PTS correlates with an increased risk of recurrent VTE or vice versa.



**Figure (4): Relation between patients' quality of Life scale and DASH Prediction Score for Recurrent VTE**

**Fig (4):** illustrates a negative correlation between patients' quality of Life scale and DASH Prediction Score for Recurrent VTE which means Improvements in QoL may reflect better disease control, which in turn reduces the likelihood of future thrombotic events or vice versa. .

### Discussion:

This study evaluated the impact of a Nurse-led intervention on clinical severity, quality of life, and recurrent venous thromboembolism (VTE) risk among patients with post-thrombotic syndrome (PTS). The findings highlight a significant improvement in the clinical severity of venous disease, patient-reported quality of life, and risk profile for recurrent VTE following the intervention.

### Regarding Demographic characteristics:

The mean ages of post-thrombotic patients (study and control group) were between  $40.4 \pm 11.1$  and  $43.8 \pm 11.2$ , respectively. Two-thirds of the patients were male, while one-third were highly educated and held university degrees. One-third of the post-thrombotic (intervention group) did not work, and one-third of the control group consisted of employees and professionals. As for marital status, more than two-thirds of the studied sample was married. The majority of the participants in

the intervention group lived in urban areas; additionally, more than two-thirds of the control group also lived in urban areas making the comprehensive discussion about this part with valid references only.

The researchers opine that the predominance of males in this study may reflect higher exposure to risk factors such as prolonged immobilization or occupational hazards among men in this age group. However, given the conflicting evidence regarding gender predisposition to PTS, further longitudinal studies stratified by sex-specific risk profiles are warranted to clarify these disparities.

### **The demographic characteristics of post-thrombotic syndrome (PTS) patients:**

The reported mean ages ( $40.4 \pm 11.1$  years for the intervention group and  $43.8 \pm 11.2$  years for the control group) indicate a middle-aged population, which aligns with other research showing that post-thrombotic syndrome (PTS) frequently affects adults in this age range. According to **Kahn et al. (2016)**, who reported that middle-aged adults are at a higher risk for developing PTS due to higher exposure to deep vein thrombosis (DVT), a primary risk factor for PTS.

The predominance of males in the patient population is noteworthy. While some studies have reported a higher incidence of PTS in women, others have found a male predominance, indicating that gender distribution may vary based on specific population characteristics and study designs.

Women were at a higher risk of PTS than men, with a cumulative incidence of near to one-third vs. less than one-fifth of patients. The influence of gender on the development of PTS showed contradictory results in previous studies. Only one follow-up study performed by **Van Dongen, et al, 2005** in 244 patients showed an increased risk of PTS among women, whereas another study performed by **Stain et al, 2005** showed an increased risk for men.

Regarding educational attainment, the observation that one-third of patients held university degrees reflects the diverse socioeconomic backgrounds of individuals affected by PTS. Education level can influence health literacy and access to healthcare resources, potentially impacting disease management and outcomes (**Jørgensen et al, 2022**).

Employment status among PTS patients varies, with some studies indicating that the condition can lead to work limitations or disability. The finding that one-third of the intervention group was unemployed, while one-third of the control group were employed professionals, underscores the potential socioeconomic impact of PTS as shown in a study performed by (**Bonnesen et al, 2021**).

Marital status and urban residency are additional factors that can influence health outcomes. (**Golab et al, 2024**) revealed that the majority of participants being married and residing in urban areas may reflect social

support systems and access to healthcare facilities, which are important considerations in managing chronic conditions like PTS.

### **Regarding the risk factors for post-thrombotic syndrome:**

The vast majority of the studied group of patients had the risk factors for developing post-thrombotic syndrome were immobilization and previous venous thromboembolism, followed by congenital venous malformation, varicose veins, and acute medical illness.

**Siddiqui et al, 2027 & Makedonov et al, (2020)** were agreeing with the present study as they revealed that "Prolonged immobilization is a well-established risk factor for deep vein thrombosis (DVT), which can lead to PTS. A case-control study identified a history of immobilization as a significant predictor for PTS development, with a p-value of 0.003, indicating a strong association. Early mobilization after DVT diagnosis is recommended to reduce the risk of PTS".

**Baglin (2009) & Tsiamita and White (2003)** agreed with the current study as revealed that "A history of VTE, particularly recurrent ipsilateral DVT, significantly increases the risk of developing PTS. Studies have shown that patients with recurrent DVT have a higher likelihood of PTS compared to those with a single episode. Additionally, poor quality anticoagulation, such as subtherapeutic international normalized ratio (INR) levels, further elevates this risk".

**Lagneaux et al.'s (2024)** results were in line with the current study, as it reveals that "thrombosis within VMs can result in deep vein thrombosis (DVT), a known precursor to PTS." Research has shown that patients with extensive VMs, particularly those involving the lower extremities, are at increased risk for thrombotic events. For instance, a retrospective study of twenty-nine patients with VMs reported that one-fifth experienced DVT, and half of one-fifth developed pulmonary embolism.

**Li et al (2022)** agreed with the present study as they conducted a randomization study that suggested a potential causal relationship between genetically predicted varicose veins and DVT, indicating that individuals with a genetic predisposition to varicose veins may have an increased risk of developing DVT.

Effective management of varicose veins is crucial in reducing the risk of DVT and subsequent PTS. Conservative measures include lifestyle modifications such as regular exercise, weight management, and leg elevation to improve venous return. Compression therapy, particularly with elastic compression stockings (ECS), has been shown to alleviate symptoms and may reduce the incidence of PTS when used consistently.

Also, **Tick et al (2008)** revealed that "A prospective study involving 1,668 patients with a first DVT found that individuals with pre-existing varicose veins had a higher risk of developing PTS. The study

reported that more than one-fifth of patients, the incidence of PTS occurs within one year, even among patients using elastic compression stockings. The presence of varicose veins before DVT was identified as an independent risk factor for PTS development".

**Müller-Bühl et al, (2012)** performed a study examining risk factors for PTS and found that the presence of varicose veins before DVT was associated with an increased risk of developing PTS. Patients with varicose veins may have impaired calf muscle pump function and pre-existing venous reflux, leading to higher venous pressures and chronic venous insufficiency, which contribute to PTS development.

### **Regarding Clinical venous severity score:**

The findings indicate that the nursing intervention significantly improved specific manifestations of PTS, including pain relief, reduced edema, skin pigmentation, inflammation, and ulcer healing, as well as enhanced adherence to compressive therapy. These are critical areas in the management of PTS, as they directly influence patient comfort, functional capacity, and long-term outcomes.

The research team notes that the significant improvements in VCSS following the nursing intervention underscore the critical role of patient education and adherence support in managing chronic conditions like PTS. They suggest that structured nursing care can bridge the gap between clinical recommendations and real-world implementation, particularly in improving compliance with compression therapy and lifestyle modifications. The most notable reductions were observed in pain, varicose veins, and skin pigmentation, suggesting that the nursing interventions—likely involving education, lifestyle modification, compression therapy, and monitoring—effectively targeted these common and distressing symptoms.

**Makedonov et al. (2020)**, were agreeing with the current study results as they revealed that “early identification and intervention are crucial for preventing progression, and interventions initiated later may yield symptom relief without altering disease stage”.

Several studies confirm that consistent use of compression therapy reduces the incidence and severity of PTS (**Nielsen et al., 2024; Araujo et al., 2023**). However, poor adherence remains a major barrier. The current study demonstrates that targeted nursing interventions can effectively address this challenge.

**Silva et al, (2021)** Engaging in regular physical activity, such as walking or specific calf exercises, has been shown to improve calf muscle pump efficiency. A systematic review highlighted that exercise training enhances ejection fraction and reduces residual volume fraction in patients with CVI, indicating improved venous return and reduced venous hypertension.

Additionally, exercise programs focusing on strengthening and stretching the lower limb muscles can

lead to improvements in ankle range of motion and overall functional capacity, further supporting venous return.

### **Regarding the Quality of life:**

The intervention group demonstrated highly significant improvements in all four quality-of-life domains after receiving the nursing intervention for three months. In contrast, the control group showed minimal change.

The researchers interpret the marked improvement in psychological well-being as a testament to the value of holistic, patient-centered care in chronic disease management. They propose that emotional support and empowerment strategies embedded in the nursing intervention likely reduced feelings of helplessness and improved self-efficacy, which are essential for long-term symptom control and functional recovery.

The findings of this study underscore the profound impact of a structured nursing intervention on enhancing the quality of life (QoL) in patients with chronic venous disease and post-thrombotic syndrome (PTS). The observed highly significant improvements across all four QoL domains—pain, physical, psychological, social, and environmental—in the intervention group after three months highlight the holistic benefits of evidence-based nursing interventions. In contrast, the minimal changes in the control group further validate that these improvements were attributable to the nursing intervention rather than natural disease progression.

One of the most striking results was the more than 60% reduction in mean scores within the psychological domain, indicating substantial relief from anxiety, depression, and emotional distress. This is particularly relevant given that chronic venous disease and PTS are associated not only with physical symptoms but also with considerable psychological burden. Patients often experience feelings of helplessness, frustration, and embarrassment due to visible symptoms such as leg ulcers, swelling, and discoloration (**Kahn et al., 2021**).

The marked improvement in psychological health suggests that the nursing intervention effectively addressed psychosocial stressors through patient education, symptom management, emotional support, and empowerment strategies. These findings align with recent literature emphasizing the importance of integrating mental health care into chronic disease management programs (**Zullig et al., 2022**).

A significant decrease in pain levels among the intervention group likely contributed to enhanced physical functioning and mobility. Chronic pain in PTS can severely limit daily activities, reduce work productivity, and impair sleep quality (**Ginsberg et al., 2021**). The nursing intervention’s focus on compression therapy, limb elevation, exercise guidance, and wound

care appears to have mitigated these debilitating symptoms, thereby promoting greater independence and functional capacity.

This is consistent with clinical guidelines recommending comprehensive conservative management for PTS, including compression therapy and lifestyle modifications to improve circulation and reduce edema (**American College of Chest Physicians [ACCP], 2022**). The integration of such evidence-based practices within the nursing framework likely played a pivotal role in alleviating pain and restoring physical function.

The notable decline in the mean of social domain indicates that patients experienced fewer limitations in their social interactions and daily roles. This outcome may reflect a combination of factors, including reduced pain, improved cosmetic appearance (e.g., healing of ulcers), and increased self-efficacy in managing their condition. As patients regain confidence in performing routine tasks and participating in social events, their overall sense of well-being improves (**Rabe et al., 2023**).

These findings echo broader research on the social determinants of health, which underscores how chronic illness can isolate individuals and restrict their participation in community life (**World Health Organization [WHO], 2021**). By addressing both physical and emotional barriers, the nursing intervention facilitated social reintegration, reinforcing its value in comprehensive patient-centered care.

In conclusion, the implementation of a structured nursing intervention significantly enhanced all domains of quality of life in patients with chronic venous disease and PTS. The most pronounced effects were seen in psychological and social domains, suggesting that beyond symptom management, the intervention had a transformative effect on patients' emotional resilience and social engagement.

#### **Regarding DASH Prediction Score :**

A clinical prediction tool used to estimate the risk of recurrent venous thromboembolism (VTE) in both the intervention group (receiving a structured nursing intervention) and the control group (standard care). After implementing the nursing intervention, the percentage of patients classified as low-risk increased to three-quarters of patients in the intervention group. This indicates that the nursing intervention significantly reduced the predicted risk of recurrent VTE, as measured by the DASH score. In contrast, the control group showed only about more than three quarters had two or more increased risks related to the DASH Prediction Score for Recurrent VTE, indicating no meaningful change in their risk profile over time without the structured nursing intervention. Also, these results underscore the critical role of nurses in managing complex chronic conditions and highlight the need for

systematic implementation of evidence-based practices in PTS and VTE care.

These findings align with recent literature emphasizing the importance of multidisciplinary approaches in managing patients with a history of VTE and PTS. Studies have shown that structured interventions can significantly reduce recurrence rates and improve long-term outcomes (**Makedonov et al., 2020 & Kearon, 2019**).

**Nielsen et al. (2024)** conducted a meta-analysis showing that consistent use of compression therapy and lifestyle modification significantly reduced PTS severity and indirectly lowered the risk of recurrent events by improving venous hemodynamics.

**Regarding correlations.** A negative correlation between these two instruments indicates that higher VCSS scores (i.e., more severe clinical manifestations of venous disease) are associated with higher CIVIQ-20 scores (i.e., poorer quality of life), and conversely, lower VCSS scores correlate with lower CIVIQ-20 scores reflecting better quality of life.

Several studies have confirmed this inverse correlation between VCSS and CIVIQ-20. A multicenter study by **Rasmussen et al. (2021)** found a statistically significant decrease in VCSS and a corresponding increase in CIVIQ-20 scores post-intervention, demonstrating that clinical improvement was paralleled by enhanced quality of life.

Similarly, **Scovell et al. (2023)** conducted a longitudinal analysis of patients undergoing treatment for chronic venous ulcers. They observed a strong negative correlation between baseline VCSS and baseline quality of life scores, reinforcing the validity of these tools in capturing both disease severity and patient-reported outcomes.

The negative correlation between the Venous Clinical Severity Score (VCSS) and the Chronic Venous Insufficiency Quality of Life Questionnaire underscores the importance of integrating both objective clinical assessment and subjective patient-reported outcomes in the management of chronic venous disease. This dual approach facilitates a more nuanced understanding of disease impact and treatment response, ultimately enhancing patient care and outcomes.

The observed negative correlation between the Venous Clinical Severity Score (VCSS) and the DASH score highlights a clinically significant relationship. This correlation suggests that patients with more severe manifestations of PTS, as indicated by higher VCSS scores, are at increased risk of experiencing recurrent VTE events, and conversely, those with lower VCSS scores tend to have a lower predicted risk of recurrence.

Patients with severe PTS often exhibit chronic venous hypertension, valvular incompetence, and microvascular changes, which may contribute to persistent low-grade inflammation, endothelial dysfunction, and stasis, all of which are components of

Virchow's triad. These factors not only perpetuate the clinical manifestations of PTS but may also predispose individuals to further thrombotic events. Moreover, studies suggest that patients who develop PTS after an index DVT are more likely to have underlying thrombophilic tendencies or inflammatory responses that increase their vulnerability to both PTS and recurrent VTE (Prandoni et al., 2020).

Several recent studies support this relationship as Carrier et al. (2019) demonstrated that patients with a history of DVT and subsequent PTS had a significantly higher risk of recurrent VTE compared to those without PTS a hazard ratio (HR: 1.6; the vast majority of confidence interval CI: 1.2–2.1), independent of other known risk factors. Di Minno et al. (2021) found that markers of endothelial injury and fibrin turnover were elevated in patients with severe PTS, suggesting a persistent prothrombotic state that could predispose to recurrent clotting.

A prospective cohort study by Cosmi et al. (2022) evaluated DASH scores about long-term outcomes in post-thrombotic patients. They reported a strong positive association between baseline VCSS and DASH scores ( $r = 0.68$ ,  $p < 0.001$ ), reinforcing the notion that PTS severity correlates with future thrombotic risk.

Timp et al. (2023) conducted a meta-analysis examining predictors of VTE recurrence and found that the presence of PTS was independently associated with a 2-fold increase in the risk of recurrent VTE, further supporting the clinical relevance of this correlation.

The positive correlation between the Venous Clinical Severity Score (VCSS) and the DASH score in patients with post-thrombotic syndrome provides valuable insight into the complex interplay between chronic venous disease and the risk of recurrent venous thromboembolism. This relationship underscores the importance of integrating both clinical staging and risk stratification models into the comprehensive management of patients following DVT.

The observed negative correlation between patients' quality of life (QoL) and the DASH score suggests that patients who report better QoL may also have lower biological markers of thrombotic risk or fewer prothrombotic comorbidities, resulting in a lower DASH score and reduced likelihood of VTE recurrence. Conversely, individuals with poorer QoL often experience elevated DASH scores.

PTS is a common complication of DVT and is strongly associated with poor QoL. Importantly, PTS itself has been linked to a higher risk of recurrent VTE, possibly due to chronic venous stasis and microvascular changes (Prandoni et al., 2020).

Carrier et al. (2019) found that patients with recurrent VTE reported significantly worse QoL scores compared to those with a single episode, even after adjusting for age and comorbidities. A prospective cohort study by Di Minno et al. (2022) demonstrated

that elevated biomarkers of coagulation activation were more prevalent in patients with lower QoL scores, suggesting a mechanistic link between impaired well-being and ongoing thrombotic activity.

Timp et al. (2023) showed that patients with persistently high DASH scores had greater functional impairment and lower VEINES-QOL scores at twelve months post-VTE, reinforcing the interplay between clinical risk and patient-reported outcomes. Ay et al. (2021) highlighted the role of psychosocial stressors in VTE recurrence, showing that patients with clinically significant anxiety had both lower EQ-5D scores and higher rates of recurrent clotting over a two year follow-up period.

The negative correlation between health-related quality of life and the DASH prediction score highlights the importance of adopting a holistic approach to managing patients after VTE. Integrating patient-reported outcomes with clinical risk assessment tools allows for more nuanced, personalized decision-making that considers both the biological and experiential dimensions of thrombotic disease.

The researchers conclude that nurse-led interventions represent a promising strategy for improving outcomes across multiple dimensions—clinical severity, quality of life, and thrombotic risk—in patients with post-thrombotic syndrome. They recommend the wider adoption of structured nursing interventions in PTS management and call for future research to explore the long-term sustainability of these benefits and their cost-effectiveness in diverse healthcare settings.

## Conclusion:

- Post-thrombotic syndrome (PTS) remains a significant global health burden, affecting 20–50% of deep vein thrombosis (DVT) survivors and severely impairing quality of life (QoL), with up to 10% developing severe disease.
- This quasi-experimental study demonstrates that structured nurse-led interventions significantly improve clinical outcomes, enhance QoL, and reduce the risk of recurrent venous thromboembolism (VTE) in PTS patients.
- The Venous Clinical Severity Score (VCSS) showed marked reductions in symptom severity—including pain, edema, skin pigmentation, ulceration, and inflammation—indicating effective symptom control through comprehensive nursing care.
- CIVIQ-20 scores revealed substantial improvements across all QoL domains, with over a 60% reduction in psychological distress, highlighting the psychosocial benefits of patient-centered nursing strategies.
- The DASH score demonstrated a notable shift in VTE recurrence risk: 73.3% of the intervention group was reclassified as low risk compared to

only 23.3% in the control group, underscoring the preventive value of structured interventions.

- Strong correlations were observed between reduced clinical severity, improved QoL, and lower recurrence risk, reinforcing the importance of integrated outcome assessment in PTS management.

### Recommendations:

- Implement comprehensive, structured nursing intervention—including patient education, compression therapy, lifestyle modifications, and psychosocial support—as standard components of PTS management to improve clinical outcomes and quality of life.
- Create and disseminate accessible, culturally appropriate educational tools (e.g., booklets, digital resources) to enhance patient understanding of PTS, its management, and prevention of recurrence.
- Expand research to include diverse populations across different regions to validate findings, assess cost-effectiveness, and inform the global implementation of nurse-led PTS interventions.

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