Effect of Training Module on the Clinical Outcomes of Patients Undergoing Peripheral Balloon Angioplasty and Stent Placement

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Abstract:

Background: Endovascular revascularization is a less invasive alternative procedure and is linked to fewer complications during the procedure, Alleviate pain and enhances blood flow to the limb to preserve the leg, enhance quality of life. **Aim: -** aimed to assess the impact of a training module on the clinical outcomes of patients undergoing peripheral balloon angioplasty and stent placement. **Subjects and method:** A quasi-experimental research design was used to collect data from Vascular Department and outpatient's At Main Tanta University Hospital. **Sample**: A non-probability sampling. of (60) adult patients undergoing peripheral balloon angioplasty and stent placement in the aforementioned setting, **Tools:** Four tools were utilized for data collection; **Tool (I):** Structured Interview about peripheral balloon angioplasty and stent placement Questionnaire. **Tool (II):** Lower Extremity Functional Scale**, Tool (III):** The Peripheral Artery Questionnaire **Tool (IV):** Post peripheral balloon angioplasty and stent placement Clinical Outcomes Assessment Tool. **Results:** As a result of this study, it was determined that all (100%) of the patients initially had a poor level of knowledge, which significantly improved to 100% after the training module was implemented. Additionally, after four weeks, 53.33% of patients had no difficulty according to the LEFS, and there was an improvement in PAD symptoms as P value= (0.000). Ultimately, the clinical outcomes for patients improved. In **conclusion**, the study demonstrated a significant enhancement in patient knowledge about peripheral balloon angioplasty and stent placement, LEFS, PAD symptoms, and overall clinical outcomes following the implementation of the training module. **Recommendation**: development of a training module as a standard part of nursing care for all patients undergoing peripheral angiography procedures.

Keywords: Clinical Outcomes, Stent Placement, Training Module.

Introduction

One type of atherosclerotic vascular disease is peripheral artery disease. It is frequently underdiagnosed and unrecognized despite its great frequency. Its clinical manifestations, including decreased walking, classic intermittent claudication, and critical limb ischemia, as well as the associated negative cardiovascular events and limb outcomes, are not well understood **Campia, et al.(2019),**The majority of individuals with PAD, which is caused by atherosclerotic occlusive disease, have exercise limits, but less frequently, traditional symptoms including ischemia ulceration, ischemic rest discomfort, and intermittent claudication occur **Marius et al. (2014),**The prevalence of PAD is 14.9% for those > 45 years of age, and 15–2o% for those > 7o years.2–6, demands a responsive approach to ensure the early detection and treatment of PAD especially since arterial insufficiency is the main cause of arterial ulcers. PAD's worldwide burden is continuously increasing, with 202 million people affected, and this number increases yearly. There was a 23.5% rise in PAD prevalence during the first decade of the new millennium. **Weir et al. (2014).** Individuals with diabetes are more likely to have PAD, which increases their risk of death, amputation, and non-healing ulcers. Therefore, the increasing number of people with diabetes, which the World Health Organization estimates will reach 578 million by 2030, is probably the main cause of the rising incidence of PAD. **Ramachandran et al.(2023),**PAD symptoms are brought on by inadequate arterial blood flow to the lower limbs, which frequently leads to ischemia-induced, incapacitating limping. Claudication, which is characterized by cramping, aching, or soreness in the calves, thighs, or buttocks, is a hallmark symptom of PAD. In order to protect the leg, enhance quality of life, and prevent devastating amputations, the primary objectives should always be to reduce pain and improve limb perfusion. **Djedović et al. (2023),**These advantages make nursing practice in PVD essential in clinical care, and it should be promoted in a number of ways, including safety protocols, educational services, and safer technology training courses that significantly reduce issues **Abd El-Hay (2015) .** A training module is a type of instructional guide that is primarily used to teach and learn patient procedures. Additionally, it can be used to provide truth knowledge for real-world experience. **Nababan and Saragih (2018).**The training module was created to improve patient clinical advanced standards. It involves identifying requirement, developing teaching objectives and items, preparing training materials, scheduling, designing training sessions, implementing skills, and monitoring and evaluating the module. To address these educational needs, educational nursing institutions must have a training module on peripheral vascular revascularization that encourages the learning process. **Levett-Jones T.(2011).**

Significance of the Study: Patients undergoing peripheral angioplasty face a high risk of infection (60%), walking

problems (55%), and blood clotting (40%). By assessing how a training module impacts the clinical outcome for the patient having peripheral balloon angioplasty and stent placement, these problems could be resolved. **Aim of the study** is to be evaluating how a training module impacts the clinical outcome of patients that have stent placement and peripheral balloon angioplasty. **Research Hypothesis**

-After applying the training module, patients showed improved knowledge about the peripheral balloon angioplasty and stent placement procedure.

-Following the training module, patients demonstrated better clinical outcomes comparing to the control group.

Subjects and Method

Research design: A quasi- experimental research design was utilized to conduct the study.

Study Setting: The study was conducted at Vascular Department and its relevant outpatient's clinics at Main Tanta University Hospital.

Subjects: A convenience sampling of (60) adult patients undergoing peripheral balloon angioplasty and stent placement from above mentioned setting, the sample size was calculated based on epidemiological information program based on total patient per year (2022) according to review of Tanta educational hospital statistical recorded .The sample was divided randomly into two equal groups each group consisted of (30) patient as the following:- **control group;** consisted of (30) patient, they were receive their routine care by hospital nursing staff, **study group;** consisted of (30) patients they were receive training module care that was designed and implemented by the researcher in addition to routine care.

Inclusion criteria: Adult patients of both genders aged 21-60 years, with a primary diagnosis of lower limb ischemia.

Exclusion criteria: Patient with systemic thrombolysis, those with intracranial hemorrhage, stroke, or transient ischemic attack, patients with a history of contrast allergies, and those with impaired renal function. **Tools of the study:**

Four tools were used as the following:

Tool (I): Structured Interview about peripheral balloon angioplasty and stent placement Questionnaire.

It was comprised of three parts:

Part (1): socio-demographic characteristic of the patient, which Includes: patient code, age, gender, marital status, educational level, smoking, occupation and residence.

Part (2): patients' clinical assessment; which include: current diagnosis, present history, past medical history, surgical history, body mass index , weight, height, date of admission and procedure, and date of discharge, duration of hospitalization, and types of drug used.

Part (3): Patient Knowledge Assessment Sheet: It was developed by the researcher after reviewing of relate literature **Karahan et al. (2020)**, **Elbadawi et al.(2021)**, to gather the patient knowledge before and after application of training module, include the following:-

Total of thirty questions assessed knowledge of peripheral balloon angioplasty and stent implantation the

thirty questions on management knowledge before and after the procedure included the following: knowledge of pain management techniques and sleep disturbance treatment patterns, which included seven questions.

Scoring system of knowledge

Three level of scoring for questions were as the following:

Correct and complete answer scored (2)

Correct and incomplete answer scored (1)

Don't know or incorrect scored (0)

The total scoring system of the patient's knowledge for (67) question was calculated and classified as the following:

-High → > 75% of the total score.

-Moderate → ≥ 6o% - 75% of the total score.

- Low → < 6o% of the total score.

Tool (II): Lower Extremity Functional Scale:-The Lower Extremity Functional Scale was developed by **Binkley et al. (1999)**' **and updated by Pua etal., (2009),** it is a questionnaire which contain (2o questions) about a person's ability to perform everyday tasks post lower limb surgery. **Scoring system:** Each item is scored according to a 5-points Likert Scale ranging from 1 (Extreme Difficulty or Unable to Perform Activity) to 5 (No Difficulty). Final maximum score is 80 indicating very high function. The minimum possible score is 0 points, indicating very low function.

Tool (III): The Peripheral Artery Questionnaire: The PAQ was developed by **Spertus, John et al. (2004),** It is a 20-item, self-administered health status questionnaire for PAD patients. Every question inquires about PAD-related symptoms during the preceding four weeks. Six domains are given for scoring :physical disturbances, treatment satisfaction, social activities, symptoms, symptom stability (symptoms change), and the life quality indicator.

Scoring system

The average of the physical limitation, symptoms, quality of life, and social functioning ratings is used to determine the summary score. Higher scores, which range from 0 to 100, are indicative of improved quality of life, reduced symptoms, improved treatment satisfaction, increased social functioning, and decreased functional limitation.

Tool (IV): Post peripheral balloon angioplasty and stent placement Clinical Outcomes Assessment Tool. It comprises of 2 parts:

Part (1): Intermittent claudication Pain Rating Scale

Intermittent claudication Pain Rating Scale was derived from the LANSS Pain Scale Leeds used for Assessment of Neuropathic Symptoms and Signs pain that developed by **Bennett (2001**), **Morrozoff (2023).** It will be used to measure pain intensity as the following**:(0)** No pain ,no tightness or no tiredness, **(0.5)** No pain, some tightness or tiredness,**(1)**Slight pain, but very minimal, very tolerable, **(2)** Moderate pain, more than slight but still tolerable,**(3)**Sever pain ,it really hurts, it is barely tolerable**,(4)** Intolerable pain ,any exercise must cease immediately.

Scoring system: Claudication pain scale is a continuous scale from **1** indicating no pain to **5** indicating severe pain.

Part (2): Infection Assessment sheet: It was adopted by the researcher after too many related review of literature **Wang (2024)** to detect the presence of infection and determine the suitable level of innervating procedure. It will be (10) questions to cover the most common related signs and symptoms. **Scoring system:** as the following; if the problem presented scored **(1)** and if the problem absented scored **(0).**

Total Scoring system: calculated as the following:

(1-3) Grade (1) Mild site infection.
(4-6) Grade **(2)** Moderate site infection.
(7-9) Grade **(3)** severe site infection.

Part (3): Hemostatic Scale for hematoma and bleeding. It was develop by **Hogan-Miller (1995**), and updated by **El Gendy et al, (2019)**. An ordinal scale, ranging from 0 to 4, was utilized to grade hematomas and bleeding in order to assess their creation. There will be four possible scores: 0 for no bleeding, 1 for little hematoma, scarce oozing, 2 for moderate hematoma or bleeding, 3 for major hematoma or bleeding, and 4 for huge hematoma that requires surgery.

Ethical consideration

The directors of Tanta Main University Hospital's Clinical Vascular Department granted the required formal authorization. Informed consent was sought from every patient following explanation goal of the study to participate in the study. Privacy and confidentiality were taken into account when gathering data. Instead of a name, a unique number was used. The patient was made aware of their freedom to leave the study at any moment and for any reason.

Methods of data collection

- The researcher reviewed the literature to gather data before developing all of the study's tools, with the exception of except tool (II); Functional Scale was developed by **Binkley et al. (1999)**', and tool (III) The Peripheral Artery Questionnaire was developed by **Spertus, et al. (2004).**

-A panel of five experts in the fields of vascular surgery, medical surgical nursing, and nursing care protocol evaluated all of the tools for content validity. Their comments on the format and consistency of the tools were gathered, and the results were calculated and found to be = (98%).

- All tools were tested for reliability using Cronbuch`s alpha test.

- **Pilot study** was conducted on (10%) of patients to test the feasibility, clarity, relevance and organization of the tools and to determine any obstacles that may be encountered during the period of data collection; needed modification was done. The pilot study excluded from the study subjects.

-**The Training Module;** was conducted through four many phases for every patient individually. The four phases which are Assessment (determining patient needs), develop learning objectives and content of training module, prepare training learning materials, prepare training schedules, designing a training session, implementation of training module skills and monitoring & evaluation of training module .It was presented on four phases which include the following:-

A-Assessment phase: (Determination patient needs) The researcher evaluated

the patient baseline data as soon as the patient was admitted to the department by:- using tool (I), tool (II) and tool (III) to assess a patient's functional disability and level of knowledge ,The Peripheral Artery Questionnaire and Post peripheral balloon angioplasty and stent placement Clinical Outcomes Assessment Tool

B-Developing the training module's learning objectives and content; planning stage; training curriculum has been developed following a review of the related literature. **Walter (2019)، Nababan T & SaragihE (2018).**

C- Preparing the content of training module: Content was created by the researcher using the appropriate literature as a guide. **Walter (2019) Nababan & Saragih (2018) and, El Gendy et al, (2019),** an organized booklet with illustrations was created to be used as the patient's guide. Prior to the deployment of the training module, the control group got standard hospital nursing care.

D-Prepare the training learning materials; the researcher prepared all resource materials that were include; session task, skills and overview which contains story and objectives, focus groups, training-on-the safety measures, power point, and video, re demonstration. Choose methods for learning as; self-guided or self-based learning, learn better from reading .

E- Preparing the environment; was performed to maintain privacy for the patient during the application training module and good ventilation .

F-Prepare training Schedules: Each patient was individually interviewed to fulfill the sheet questions; also each interview lasted for about 30-45 minutes to complete the tools during 2 shifts at the morning shift, and the afternoon shift .

Field work: - study conducted in duration of time from 6-12 months.

G- Designing a training session: Training sessions was implemented, over (4) sessions (1) theory, and (2) Designing a training session: Training was conducted in four sessions: (1) theory; (2) skills for problem-solving; (3) session-specific learning activities (practice or knowledge); and (4) summary. Every session began with a pretest and concluded with a post-test. The morning and afternoon shifts were used for the sessions.

H-Implementation of training module:

Study group: - training module was implemented by the researcher through schedule which divided into four educational sessions that was provided for each group as the following:

First session: was include pretest for all patient regarding peripheral balloon angioplasty and stent placement

Contents: identify training module, purpose of peripheral balloon angioplasty and stent placement, indication and contraindications, signs and symptoms of vascular disease and peripheral artery disease risk factors, types of peripheral balloon angioplasty, immediate and post-procedural complications.

Second session: Contents: Pre-Procedure and post-procedural care management includes routine vessel patency assessments, physical examinations, diagnostic testing, laboratory analysis, preparation, immediate post-procedural care, post-

procedural and rehabilitative care, and post-discharge education.

Third session: - **Content:** It included the following: demonstration of care regarding, pre-procedure preparation and assessment, physical examination, post procedure assessment, pain control measures, diabetes assessment the complication,

The fourth session:- **Content**: It included the following: demonstration, exercise program and apply pain control measures, post discharge instruction about physical activities, personal hygiene, follow pharmacotherapy and warning signs.

Control group; obtained the standard nursing care that vascular surgical nurses gave to the patients.

Monitoring and Evaluation of training module

Every patient in both groups was being assessed 4 times:-**Tool (I) (part 1, 2 and part 3)** was used before, immediately, post one week, then one month of training module. **Tool (II)** was used before, immediately, post one week, then one month after application of training module. **Tool (III)** was used before, immediately, post one week, then one month after application of training module. **Tool (IV) part 1, 2 and 3,** were used before, immediately, post one week, then one month after application of training module.

Method of data analysis:- SPSS software, a statistical computer package version 25, was used to arrange, tabulate, and statistically evaluate the data that had been gathered. The Chi square test ($\chi 2$) was used to compare qualitative data. The F-value of analysis of variance (ANOVA) was computed for comparison of means for variables over three intervention periods in a group or for more than two variables. Pearson and Spearman's correlation coefficient (r) was used to assess the correlation between the variables. To interpret the results of tests of significance, a significance level of $P<0.05$ was chosen (*).

Results:

Table (1): distribution the socio-demographic characteristics of the patients undergoing peripheral balloon angioplasty and stent placement accordingly.

In the study group, approximately two-thirds of the patients (70%) were aged between 50-60 years. About 73.33% were male, and all were married. Most had Secondary Technical education (73.33%), while a small fraction (3.33%) had Preparatory education. Regarding occupation, 60% were employees, and 13.33% were manual workers. Additionally, 70% were smokers.

In the control group, 80% of the patients were aged between 50-60 years. Around 70% were male, and all were married. The majority (90%) had Secondary/Technical education. In terms of occupation, 60% were employees, and 26.67% were housewives. About 73.33% were smokers.

Figure (1): Distribution of the studied patients regarding their total knowledge level about peripheral balloon angioplasty and stent placement among studied groups.

In the study group, most patients initially had poor knowledge about peripheral

balloon angioplasty and stent placement. However, there was a significant improvement in their knowledge immediately after, one week after, and four weeks after the training module was implemented, with a p-value of 0.00. In contrast, the control group showed no significant improvement in their overall knowledge level.

Figure (2): Distribution of the studied patients regarding total level of functional impairment with a disorder of one or both lower extremities

In the study group, all patients (100%) had severe disabilities and were unable to perform activities before the training module. There was a gradual improvement, with 13% having moderate disabilities immediately after the training, and 53.33% experiencing no difficulty four weeks later. In contrast, the control group showed consistently high levels of disability, with 100%, 93.33%, and 86.66% unable to perform activities before, immediately after, and four weeks after the training, respectively.

Figure (3): Distribution of studied patients undergoing peripheral balloon angioplasty and stent placement regarding total peripheral artery symptom level.

In the study group, all patients (100%) had severe signs and symptoms of peripheral artery disease before the training module. There was a gradual improvement, and by four weeks post-training, all patients (100%) showed improvement. There were statistically significant differences in the total peripheral artery disease levels between pre- and immediately post-training, with a p-value of 0.000. In contrast, the control group showed no significant improvement in their condition after receiving routine hospital care.

Figure (4): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding their pain intensity level.

In the study group, 90% of patients experienced intolerable pain before the training module. Gradual improvement was observed, and by four weeks post-training, all patients reported no pain or tightness. There was a statistically significant improvement in pain intensity levels between pre- and immediately post-training, with a p-value of 0.000. In contrast, the control group showed no significant improvement in pain levels after receiving routine hospital care.

Figure (5): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding their infection level.

In the study group, over half of the patients (56.67%) had severe infections before the training module. Their condition gradually improved, and by four weeks post-training, about 86.67% showed no signs of infection. There were statistically significant differences in infection levels between pre- and immediately post-training, with a p-value of 0.000.

Figure (6): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding assessment of hematoma formation and bleeding.

There was a statistically significant improvement in hematoma formation and

bleeding among the studied patients between pre- and immediately post-training, with a p-value of 0.000. In contrast, the control group showed no significant improvement in these conditions.

Table (2): Correlation between knowledge score of studied patients and their LEFS, PAD, pain intensity, infection and hematoma throughout periods of intervention.

In the study group, there was a highly significant positive correlation between the total level of knowledge and the total LEFS score four weeks post-training, with (r = 0.478) and (p = 0.008). Regarding the Total PAD score, there was a highly significant negative correlation between the total level of knowledge and the Total PAD score. Additionally, there were non-significant positive correlations between the total level of knowledge and the Total PAD score four weeks post-training, with (r = 0.279) and (p = 0.135).

Regarding pain intensity, there were significant negative correlations between the total level of knowledge and pain intensity among the studied patients before the training module, with (r = -0.394) and (p = 0.031). Post-implementation, there were highly significant positive correlations one week after the training, with (r = 0.318) and (p = 0.005).

For infection levels, there were non-significant negative correlations between the total level of knowledge and infection levels before the training module, with (r = -0.731) and (p = 0.611). Four weeks post-training, there were also non-significant negative correlations, with (r = -0.011) and (p = 0.952).

Regarding hematoma, there were non-significant negative correlations between the total levels of knowledge and hematoma formation before the training module, with (r = -0.209) and (p = 0.268). However, there were significant negative correlations one week post-training, with (r = -0.247) and (p = 0.047).

In the control group, there were no significant negative correlations between the total level of knowledge and any of the measured items.

Table (1): percent distribution of studied patients undergoing peripheral balloon angioplasty and stent placement regarding their socio-demographic characteristics among the studied groups.

Characteristics	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
Age (in years)					
(30-<40)	0	0.00	1	3.33	1.873
(40-<50)	6	20.00	8	26.67	0.392
(50-60)	24	80.00	21	70.00	
Range	(49-59)		(33-59)		**t=2.058**
Mean ± SD	55.20±3.49		52.77±5.46		**P=0.044***
Gender					
Female	8	26.67	9	30.00	FE
Male	22	73.33	21	70.00	1.00
Marital status					
Married	30	100.00	30	100.00	-
Level of education					
Preparatory education	0	0.00	1	3.33	3.110
Secondary/Technical education	27	90.00	22	73.33	0.211
University	3	10.00	7	23.33	
Occupation					
Housewife	8	26.67	8	26.67	0.00
Employee	18	60.00	18	60.00	1.00
Manual work	4	13.33	4	13.33	
Smoking					
No	8	26.67	9	30.00	FE
Yes	22	73.33	21	70.00	1.00
Number of cigarette/day					
Range	(0-12)		(0-10)		0.635
Mean ± SD	6.87±4.31		6.17±4.23		0.528
Length of smoking (in years)					
Range	(0-30)		(0-30)		0.644
Mean ± SD	18.97±12.27		16.97±11.78		0.522

Figure (1): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding their total knowledge level about peripheral balloo angioplasty and stent placement among the studied groups

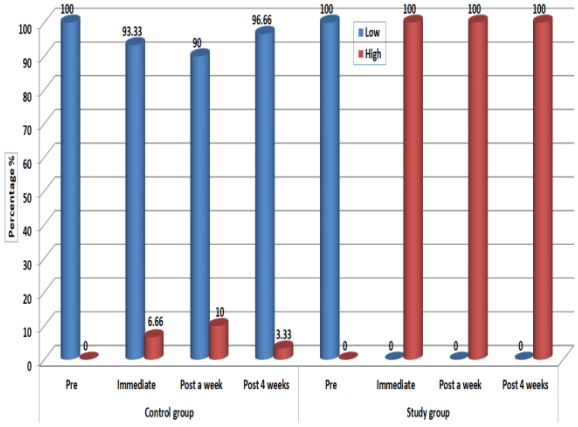

Figure (2): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding total level of evaluating their functional impairment with a disorder of one or both lower extremities and to evaluate the effectiveness of an intervention

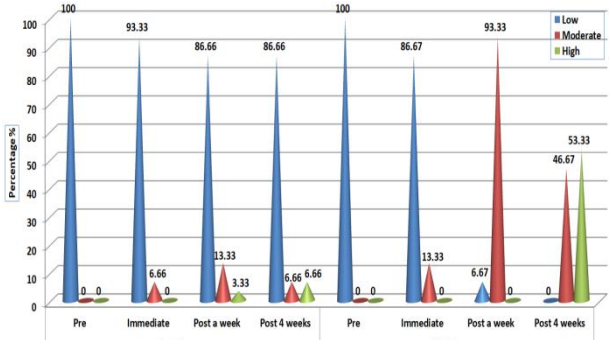

Figure (3): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding total peripheral artery level

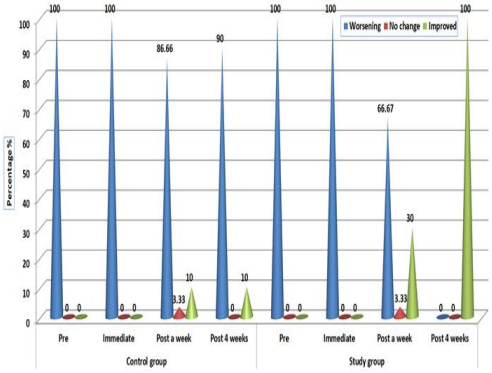

Figure (4): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding their pain intensity level

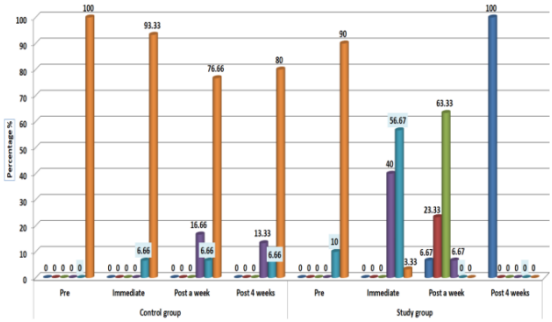

Figure (5): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding their infection level

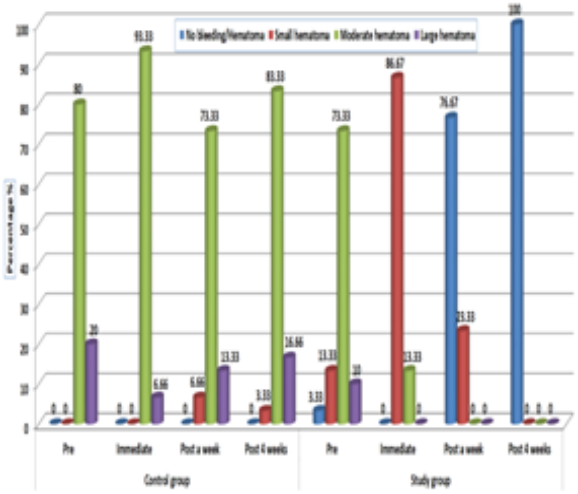

Figure (6): Distribution of the studied patients undergoing peripheral balloon angioplasty and stent placement regarding assessment of hematoma formation

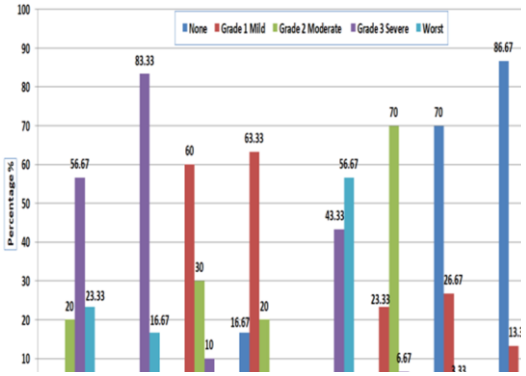

Table (2): Correlation between knowledge score of the studied patients undergoing peripheral balloon angioplasty and stent placement and their LEFS, PAO, pain intensity, infection and hematoma throughout periods of intervention

		The studied patients (n=60) Total knowledge score							
		Control group (n=30)				Study group (n=30)			
		Pre	Immediate	Post a week	Post 4 weeks	Pre	Immediate	Post a week	Post 4 weeks
Total LEFS score	R	-0.307	-0.173	-0.204	0.498	-0.263	-0.355	-0.205	0.478
	P	0.099	0.360	0.279	0.087	0.160	0.054	0.007**	0.008**
Total PAO score	R	-0.312	-0.481	-0.256	0.267	-0.561	-0.483	-0.214	0.279
	P	0.093	0.277	0.172	0.154	0.001**	0.007**	0.028*	0.135
Pain intensity level	R	-	-	-0.355	-0.279	-0.394	0.215	0.318	-
	P			0.054	0.135	0.031*	0.000**	0.005**	
Infection level	R	-0.366	-0.295	0.009	-0.731	-0.097	0.146	-0.409	-0.011
	P	0.187	0.113	0.964	0.253	0.611	0.441	0.025*	0.952
Hematoma	R	-0.014	-0.401	-0.069	0.155	-0.209	-0.372	-0.247	-
	P	0.939	0.255	0.715	0.414	0.268	0.043*	0.047*	

Discussion

Angioplasty is a minimally invasive procedure to widen narrowed arteries by targeting and reshaping atherosclerotic plaque to improve blood flow. In the study, about two-thirds of the patients were aged between 50 and 60 years, and two-thirds were male. These findings are consistent with **Gurin et al. (2021),** who reported an average patient age of 69±12 years, with half being men.

Regarding education, more than two-thirds of the study group had secondary or technical education, aligning with **Builyte et al. (2019),** who found lower educational levels among PAD patients. In terms of occupation, less than two-thirds of the patients were employed, consistent with **Pande et al. (2014),** who noted higher cardiovascular risk factors among individuals in lower income categories, including smoking, diabetes, hypertension, and hyperlipidemia.

The study found that two-thirds of the patients were smokers, consistent with **Eid et al. (2021)**, who identified smoking as a significant risk factor for peripheral artery disease (PAD). Regarding body mass index (BMI), most patients were obese (BMI ≥ 30). This aligns with **Lim et al. (2021),** who observed that multilevel vessel disease and infra-popliteal artery disease were more common in obese groups compared to

normal weight and overweight groups**. Azuma et al. (2014)** highlighted that knowledge about ulcer healing, especially in the context of revascularization, is insufficient. Although guidelines for managing diabetic foot ulcers are well-established, there is limited evidence supporting strategies for the complete healing of ischemic ulcers following revascularization.

Regarding the evaluation of functional levels, rehabilitation was assessed using the LEFS. There was an improvement in overall functioning of individuals after 12 weeks of rehabilitation management.

The study revealed that all patients had severe signs and symptoms of peripheral artery disease before the training module, which gradually improved over four weeks. Statistically significant differences were observed between the pre- and immediate post-implementation phases ($p = 0.000$). This aligns with **Tran (2022),** who noted that worsening claudication was associated with improved survival, with recent assessments being the most prognostic.

Regarding pain intensity, the majority of patients experienced intolerable pain before the training module, which gradually improved post-implementation, with all patients reporting no pain or tightness. This is consistent with **Fakhry (2015),** who found that a combination of endovascular revascularization and supervised exercise led to greater improvements in walking distances and quality of life for patients with intermittent claudication.

The study revealed a statistically significant improvement in ten infection-related items among patients during the training module, attributed to following infection prevention instructions. This aligns with **El Gendy et al. (2019),** who reported no signs of infection in the study group, while one control group patient showed local infection.

Regarding hematoma formation and bleeding, most patients had moderate hematomas before the training module, which improved to small hematomas immediately after. There was a significant improvement in hematoma formation and bleeding post-training, while most control patients had moderate hematomas four weeks later. This is consistent with **El Gendy et al. (2019),** who found only a small number of control patients had large hematomas immediately and two hours post-procedure.

The study showed highly significant positive correlations between total knowledge and LEFS scores four weeks post-training, with no significant correlations in the control group. This aligns with **Schmid (2024),** who noted significant improvements in foot rotation and hip joint range of motion post-surgical revascularization. There were no significant positive correlations between total knowledge and PAQ scores post-training, consistent with **Byskosh (2022),** who found significant gaps in PAD awareness.

Regarding pain intensity, there were highly significant positive correlations between total knowledge and pain intensity post-training, aligning with

Fakhry (2015), who noted improved quality of life scores with combined revascularization and supervised exercise. There were no significant negative correlations between total knowledge and infection levels post-training, consistent with **Mayor (2019)**, who found wound severity to be the most significant factor post-revascularization.

For hematomas, there were significant negative correlations between total knowledge and hematoma size immediately and one week post-training, with no significant correlations in the control group. This aligns **with Ibrahim and Deif (2021)**, who found a significant reduction in hematoma size after ice application.

Conclusion: The training module improved patients' knowledge about peripheral balloon angioplasty and stent placement.

Recommendations

Upon completion of this study, the following recommendations are made:

1. **Routine Implementation**: The training module for peripheral balloon angioplasty and stent placement should be integrated into routine nursing care for all patients undergoing peripheral angiography procedures.
2. **Discharge Instructions**: All patients undergoing peripheral balloon angioplasty and stent placement should receive a discharge instruction booklet, which will be highly beneficial for their post-procedure care.

References

Abd El-Hay, S. (2015). Prevention of needle stick and sharp injuries during clinical training among undergraduate nursing students: Effect of educational program**.** *IoSR J Nurs Health Sci*, *4*(4), 19-32.

Azuma, N., Koya, A., Uchida, D., Saito, Y., & Uchida, H. (2014). Ulcer Healing After Peripheral Intervention–Can We Predict It Before evascularization? *Circulation Journal*, *78*(8), 1791-1800.

Beaumier Weir, G. R., Smart, H., van Marle, J., & Cronje, F. J. (2014). Arterial disease ulcers, part clinical diagnosis and investigation. *Advances in skin & wound care*, *27*(9), 421-428.

Bennett, M. (2001). The LANSS Pain Scale: the Leeds assessment of neuropathic symptoms and signs. *Pain*, *92*(1-2), 147-157.

Binkley, M., Stratford W., Lott, A., Riddle, L., & North American orthopaedic Rehabilitation Research Network. (1999). The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. *Physical therapy*, *79*(4), 371-383.

Builyte, U., Baltrunas, T., Butkute, E., Srinanthalogen, R., Skrebunas, A., Urbonavicius, S., & Rucinskas, K. (2019). Peripheral artery disease patients are poorly aware of their disease. Scandinavian *cardiovascular Journal*, *53*(6), 373-378.

Bush, L., Kallen, A., Liles, R., Bates, T., & Petersen, A. (2008). Knowledge and awareness of peripheral vascular disease are poor among women at risk for cardiovascular disease. *Journal of Surgical Research*, *145*(2), 313-319.

Byskosh, N., Pamulapati, V., Xu, S., Vavra, K., Hoel, W., Tian, L., ... & Ho, K. J. (2022). Identifying gaps in disease knowledge among patients with peripheral artery disease. *Journal of vascular surgery*, *75*(4), 1358-1368.

Campia, U., Gerhard-Herman, M., Piazza, G., & Goldhaber, S. Z. (2019). Peripheral artery disease: past, present, and future. The *American journal of medicine*, *132*(10), 1133-1141**.**

Djedović, M., Hadžimehmedagić, A., Šahinović, A., Džaferović, D., Djedović, S., & Džanković, F. (2023). Impact of diabetes mellitus on early outcomes after lower leg amputations in patients with peripheral arterial occlusive disease. *Medical Journal/Medicinski Žurnal, 29*(1).

Eid, A., Mehta, S., & Goodney, P. (2021, March). Epidemiology of peripheral artery disease. *In Seminars in Vascular Surgery* , *34*(1), 38-46. WB Saunders.

El Gendy R, ELshemy M, Tag El din E and Abd Allah A. (2019). Effect of Nursing Intervention on Clinical outcomes for Patients Receiving Cerebral Angiography, *IoSR Journal of Nursing and Health Science (IoSR-JNHS),; 8* (1):12-22.

Elbadawi, A., Elgendy, Y., Saad, M., Elzeneini, M., Megaly, M., omer, M., & Aronow, H. D. (2021). Contemporary revascularization strategies and outcomes among patients with diabetes with critical limb ischemia: insights from the national inpatient sample. *Cardiovascular Interventions, 14*(6), 664-674.

Fakhry, F., Spronk, S., van der Laan, L., Wever, J., Teijink, A., Hoffmann, H. & Hunink, M. (2015). Endovascular revascularization and supervised exercise for peripheral artery disease and intermittent claudication: a randomized clinical trial. *Jama, 314*(18), 1936-1944.

Gurin, I., Beyer, E., Weinberg, M., Parikh, A., Armstrong, J., Albaghdadi, M. S., & Secemsky, A. (2021). Health Care Utilization Following Inpatient Femoropopliteal Revascularization With Drug-Coated Balloon Angioplasty: A Nationwide Cohort Analysis. *Journal of Endovascular Therapy*, *28*(2), 246-254.

Hogan-Miller E., Rustad, D., Sendelbach, S., & Goldenberg, I. (1995). Effects of three methods of femoral site immobilization on bleeding and comfort after coronary angiogram. *American Journal of Critical Care*, *4*(2), 143-148.

Ibrahim, E., & Deif, I. (2021). Effect of local cooling application on pain intensity and size of hematoma among patients with inguinal hernia repair. *International Academic Journal of Health, Medicine and Nursing*, *2*(1), 129-141.

Karahan, o., Öcal, N., Sümer, T., Hafız, E., & Khalil, E. (2020). Investigation of the endothelial response of super elastic braided stent: An experimental evaluation. *Acta Medica Alanya*, *4*(3), 236-241.

Levett-Jones, T., Gersbach, J., Arthur, C., & Roche, J. (2011). Implementing a clinical competency assessment model that promotes critical reflection and ensures nursing graduates' readiness for professional practice. *Nurse education in practice, 11*(1), 64-69.

Lim, C., Won, H., Ko, Y. G., Lee, S. J., Ahn, C. M., Min, P. K., ... & Choi, D. (2021). Association between body mass index and clinical outcomes of peripheral artery disease after endovascular therapy: data from K-VIS ELLA registry. *Korean Circulation Journal*, 51(8), 696-7o7.

Mansoor, N., Razzaq, S., Rathore, A., Akhtar, N., & Yasmeen, R. (2013). Functional outcomes following lower extremity amputation at the armed forces institute of rehabilitation medicine using lower extremity functional scale: *Lower Extremity Amputation. Pakistan Armed Forces Medical Journal*, *63*(2), 210-215.

Marius, R., Iliuta, L., Guberna, S. M., & Sinescu, C. (2014). The role of ankle-brachial index for predicting peripheral arterial disease. *Maedica*, *9*(3), 295.ISO 690.

Morrozoff Jr, G. (2023). Recommendation for the Adoption of a Supervised Exercise Therapy Protocol for Individuals Diagnosed With Symptomatic Peripheral Artery Disease (*Doctoral dissertation, Aspen University*)**.**

Nababan, T., & Saragih, E. (2018). Designing training module to improve nursing clinical competence based on needs analysis: A developmental study. *Asian J. Sci. Res*, *11*(3).

Pua, H., Cowan, M., Wrigley, V., & Bennell, L. (2009). The lower extremity functional scale could be an alternative to the Western ontario and McMaster Universities osteoarthritis Index physical function scale. *Journal of clinical epidemiology*, *62*(10), 1103-1111.

RamachandranV., Mohanasundaram, T., Karunakaran, D., Gunasekaran, M.,&Tiwari, R. (2o23). Physiological and Pathophysiological Aspects of Diabetic Foot Ulcer and its Treatment Strategies. *Current Diabetes Reviews*, *19*(8), 127-139.

Schmid, R., Schmidt, S. K., Schrüfer, S., Schubert, D. W., Heltmann-Meyer, S., Schicht, M.,& Arkudas, A. (2024). A vascularized in vivo melanoma model suitable for metastasis research of different tumor stages using fundamentally different bioinks. *Materials Today Bio*, *26*, 101071.

Spertus, J., Jones, P., Poler, S., & Rocha-Singh, K. (2004). The peripheral artery questionnaire: a new disease-specific health status measure for patients with peripheral arterial disease. *American heart journal*, *147*(2), 301-308.

Tran, T., Spertus, A., MenaHurtado, I., Jones, G., Aronow, D., Safley, M. & Smolderen, K. (2022). Association of Disease Specific Health Status With LongTerm Survival in Peripheral Artery Disease. *Journal of the American Heart Association*, *11*(4), e022232**.**

Walter D. (2019). Training on the JoB: Step-by-Step Guidance Worksheets, Checklists, Case Examples *Everything You Need to Succeed*, https://www.oreilly.com/library/view/training ,.

Wang, X., & Wyers, C. (2024). Lower Extremity Arterial Reconstruction in Patients with Diabetes Mellitus: Principles of Treatment. In The Diabetic Foot: *Medical and Surgical Management* (pp. 433-455)**.**

Wann Hansson, C., Hallberg, R., Risberg, B., Lundell, A., & Klevsgard, R. (2005). Healthrelated quality of life after revascularization for peripheral arterial occlusive disease: longterm followup. *Journal of Advanced Nursing*, *51*(3), 227-235.