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Araştırma Makalesi/ Research Article

Assessment of Information Needs, Practices, and Challenges Encountered by Patients in Postoperative Period Regarding the Use of Anti-Embolism Stockings

Ameliyat Sonrası Dönemdeki Hastaların Anti-Emboli Çorabı Kullanımına İlişkin Bilgi Gereksinimleri, Uygulamaları ve Yaşadıkları Sorunların Değerlendirilmesi

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ABSTRACT

Objective: The aim of this study is to identify the information needs, practices, and challenges encountered by patients in the postoperative period regarding the use of anti-embolism stockings (AES).

Methods: This study was carried out in descriptive design. The study's sample group comprised 351 patients who utilized AES for a minimum of 48 hours during the postoperative period in the departments of orthopedics, neurosurgery, and general surgery at the Health Research and Practice Center affiliated with a university in Ankara, between September 25, 2017, and September 26, 2018. A questionnaire developed by the researcher, including questions about sociodemographic characteristics and the use of AES, was used to collect data. The data was obtained by face-to-face interview method.

Results: Approximately half of the patients in this study reported receiving information about AES. It was determined that the size of the AES of almost all patients was determined without measuring their legs. Most patients were found to have never removed their stockings throughout their usage and never washed them. The problems experienced by the patients while using AES were respectively; difficulty in wearing, increased temperature, curling, redness, sweating, and itching. Furthermore, it was determined that female patients statistically suffered from pain, curling, redness, and stage 1 pressure injuries significantly more than men.

Conclusion: In this study, it has been determined that patients in the postoperative period have a need for information regarding AES and experience various problems due to incorrect usage.

Key Words: Anti-embolism stockings, venous thromboembolism, nursing, postoperative patient

ÖZ

Amaç: Bu çalışmanın amacı; ameliyat sonrası dönemdeki hastaların anti-emboli çorabı (AEÇ) kullanımına ilişkin bilgi gereksinimleri, uygulamaları ve yaşadıkları sorunları belirlemektir.

Yöntem: Bu araştırma tanımlayıcı tipte gerçekleştirilmiştir. Araştırmanın örneklemini, 25 Eylül 2017- 26 Eylül 2018 tarihleri arasında, Ankara'daki bir üniversitenin Sağlık Araştırma ve Uygulama Merkezi'nde ortopedi, beyin cerrahi ve genel cerrahi kliniklerinde ameliyat sonrası dönemde en az 48 saat anti-emboli çorabı giyen 351 hasta oluşturmuştur. Araştırmacı tarafından geliştirilen, sosyodemografik özellikler ve anti-emboli çorabı kullanımı ile ilgili sorular içeren bir soru formu veri toplamada kullanılmıştır. Veriler, yüz yüze görüşme yöntemi ile elde edilmiştir.

Bulgular: Bu araştırmadaki hastaların yaklaşık yarısı anti-emboli çorabı ile ilgili bilgi aldıklarını belirtmiştir. Araştırmada hastaların neredeyse tamamının anti-emboli çorabı ölçüsünün bacakları ölçülmeden saptandığı belirlenmiştir. Hastaların çoğunun çoraplarını kullandıkları süre boyunca hiç çıkartmadıkları ve çoraplarının hiç yıkanmadığı ortaya konmuştur. Hastaların anti-emboli çorabı kullanırken yaşadığı sorunlar sırasıyla; giyme zorluğu, ısı artışı, kıvrılma, kızarıklık, terleme ve kaşıntı şeklinde saptanmıştır. Ayrıca kadın hastaların ağrı, kıvrılma, kızarıklık ve evre 1 basınç yarası sorunlarını erkeklere göre, istatistiksel olarak anlamlı derecede daha fazla yaşadığı belirlenmiştir.

Sonuç: Bu çalışmada, ameliyat sonrası dönemdeki hastaların anti-emboli çorabı konusunda bilgi gereksinimi olduğu ve yanlış kullanım nedeniyle çeşitli sorunlar yaşadığı belirlenmiştir.

Anahtar Kelimeler: Anti-emboli çorapları, venöz tromboemboli, hemşirelik, postoperatif hasta

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Introduction

Healthcare-associated venous thromboembolism (VTE) has been acknowledged as a crucial public health issue (Link, 2018). As per the Centers for Disease Control and Prevention, 900,000 people in the United States are affected by VTE each year, and VTE-related death rates range from 60,000 to 100,000 per year (Centers for Disease Control and Prevention, 2023). All hospitalized patients in Turkey have at least one risk of VTE, and approximately 40% of them have three or more risks of VTE (The Ministry of Health of the Republic of Turkey, 2023). VTE; encompasses deep vein thrombosis (DVT) and pulmonary embolism (Link, 2018). DVT refers to the formation of blood clots in the deep veins of the leg or pelvis (Joanna Briggs Institute, 2008b). In case the blood clot dislodges and migrates through the venous system, eventually lodging in the lungs, it leads to the development of a pulmonary embolism (Wade et al., 2015). DVT can result in sudden death or venous insufficiency and postthrombotic syndrome due to pulmonary embolism (Joanna Briggs Institute, 2008b).

Surgical risk factors for VTE include prolonged surgery (>90 minutes or >60 minutes for lower extremities/pelvic procedures), patient positioning (e.g., hip flexion, knee hyperextension, reverse Trendelenburg), pneumatic tourniquet use, and various surgical types (orthopedic, bariatric, cardiothoracic, vascular, abdominal/pelvic, neurosurgery, spine surgery, open surgeries, emergencies, concurrent surgeries, transplants, cesarean sections, foot/ankle, and hand/wrist/elbow surgeries with hardware placement) (AORN, 2018). According to Amaral et al.'s study in 2017, the incidence of postoperative symptomatic VTE was found to be 1.33 per one thousand cases, with a mortality rate of 21.1% (Amaral et al., 2017). Appropriate thromboprophylaxis methods should be used to prevent DVT (Morrison, 2006). DVT prophylaxis includes mechanical prophylaxis and pharmacological prophylaxis. Mechanical prophylaxis encompasses compression stockings, intermittent pneumatic compression device, foot impulse devices, and early ambulation (Burlingame, 2010; Herlihy et al., 2020; Joanna Briggs Institute, 2008a; Winslow & Brosz, 2008). Compression stockings are divided into three as anti-embolism stockings (AES), graduate compression stockings and non-medical support stockings. AES is employed by individuals undergoing prolonged bed rest to prevent DVT. When used appropriately, AES significantly reduces the risk of DVT in surgical patients (Winslow & Brosz, 2008). Sachdeva et al. (2014) states that those who did not wear AES developed more DVT than those who did (Sachdeva et al., 2014).

If applied with external pressure ranging from 18 mmHg at the ankle to 8 mmHg at the middle of the femur, AES is effective in preventing venous hypertension by enhancing venous circulation (Autar, 2009). AES is available in knee or thigh length types. However, there is no clear policy yet to determine the AES length. Therefore, the stocking length should be determined according to the individual (Munoz-Figueroa & Ojo, 2015). Each brand of AES has a different measurement range for various measurement points (Macintyre et al., 2013). For thigh-length stockings, measurements should be taken at the widest circumference of both thighs, the widest circumference of both calves, and from the gluteal furrow to the heel. When selecting knee-length stockings, measurements should be obtained at the maximum circumference of both calves and from the popliteal fold to the heel. Subsequently, proper-sized stockings should be selected using the manufacturer's size chart (Gee, 2019). In addition, the leg size ranges (calf circumference, upper thigh circumference, knee high, thigh high), which are decisive in the selection of stocking size (x-small, small, medium, large, etc.), vary according to the brand of the stocking. Therefore, there is no standard measure of AES. This causes confusion about which product is more suitable for a patient (Macintyre et al., 2013).

When the literature was searched, it was found that patients often do not have enough knowledge about the reason for using AES, how and for how long they should be worn, how to care for them, and possible complications (Miller, 2011; Munoz-Figueroa & Ojo, 2015). In addition, patients had difficulty in wearing, sweating, squeezing, slipping down, curling/tourniquet effect, itching, pain, tenderness, feeling of warmth, edema, pressure injuries, numbness, discomfort related to AES (Akyuz & Tuncbilek, 2021; Miller, 2011; Rathore et al., 2017). In the study conducted by Dirimeşe et al. (2012), it was determined that the healthcare team informed 77.5% of the patients about the use of AES, demonstrating how the stockings should be worn to 58.8% of them, and 29.8% of the patients experienced difficulties in using stockings. In addition, if the AES is dressed incorrectly or applied incorrectly, it may increase the risk of DVT by causing a tourniquet effect (Munoz-Figueroa & Ojo, 2015; Winslow & Brosz, 2008). Frequently, patients

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are provided with incorrectly sized stockings, which can be excessively long, short, loose, or tight, thus either restricting circulation or impeding blood flow (Munoz-Figueroa and Ojo, 2015). In the study by Winslow and Brosz (2008), it was found that 26% of patients received improperly sized stockings, while in Miller's study (2011), this percentage was 36%.

The number of research studies conducted on the use of anti-embolism stockings in the postoperative period of patients in Turkey is limited (Akyuz & Tuncbilek, 2021; Dirimese et al., 2012; Özkan et al., 2016). Therefore, it is anticipated that the assessment of the knowledge status, practices, and challenges experienced by patients wearing AES in the postoperative period will serve as a guiding framework for the development of patient education programs, contributing to and benefiting the national and international nursing literature. In this study, it was aimed to provide correct and adequate training by health personnel to apply the right technique and care by determining the knowledge status, practices, and problems experienced by patients who used AES in the postoperative period. It is thought that with the appropriate use of AES in departments, a decrease in DVT rates and hospital stay, a decrease in complications related to stockings and an increase in patient comfort would be observed.

Methods

Design

This research was carried out in descriptive design.

Participants

The population of the study consists of patients wearing AES in the postoperative period in the orthopedic, neurosurgery, and general surgery departments at a Health Research and Application Center affiliated with a university located in Ankara. These departments were selected due to the higher postoperative risk of DVT. The research sample consists of patients who wore AES between September 25, 2017, and September 26, 2018, and met the research criteria. The inclusion criteria for participation in the study were volunteering to participate, having used AES prophylactically for a minimum of 48 hours postoperatively, being 18 years of age or older, and not having VTE, lymphedema, or varicose vein disease. We found it appropriate to include patients who wore the stockings for at least 48 hours to ensure they had a certain experience with the stockings and could become aware of any issues related to them. AES is generally put on patients by their family members in the preoperative period. Patients typically obtain the stockings themselves. It was observed that routine information about AES was not provided to patients in these departments, verbal instructions about the necessity of wearing stockings to prevent clots were given by some healthcare personnel but not documented, written educational materials were not provided, personalized care practices related to stocking use were not implemented, and there was no specific protocol followed in this regard.

At the center where the study was conducted, the total number of patients admitted to the orthopedic, general surgery, and neurosurgery departments after surgery in 2015 was 12,683. According to a study by Ferreira et al. (2017), the rate of surgical patients at risk of VTE was determined to be 54.6%. Based on these data, the population size was calculated as 6,848 by taking 54% of the annual surgery count of 12,683 from the hospital where the study was planned. To determine the sample size for the study, the formula commonly used for limited population sizes was applied, resulting in a required sample size of 350 with a 95% confidence level and 0.05 margin of error. Due to the presence of two general surgery departments in the hospital, the number of surgeries is higher, and the allocation has been proportionated to the number of surgeries performed. In this study, 143 (40.7%) patients were recruited from the general surgery department, 132 (37.6%) from the orthopedic department, and 76 (21.7%) from the neurosurgery department. In order to assess the power of the analysis conducted considering the results of the analysis comparing redness based on gender, where a significant difference was detected after the analysis, a post hoc power analysis was performed. Since a chi-square analysis was conducted for the analysis, Cramer's V was calculated as the effect size for the power analysis. Cramer's V is a measure of the relationship between two nominal variables and provides values ranging from 0 to +1 (Wooditch et al., 2021). According to the results of the conducted power analysis, the Cramer's V value for this analysis was determined to be 0.227, and the calculated power value based on this effect size was found to be 0.98. As the mean power value is greater than 0.80, it can be stated that the obtained sample is sufficient.

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Instruments

A questionnaire formed as a result of literature review was used to collect data (Clarke-Moloney et al., 2014; May et al., 2006; Winslow and Brosz, 2008). The questionnaire comprises questions regarding patient demographics (23 questions) as well as inquiries related to information requirements (5 questions), application (21 questions), and issues (2 questions) concerning AES. The problems they experienced during the use of AES were determined by measuring the leg sizes of the patients who consented to take part in the study, their compatibility with the size of the AES they wore, and their skin evaluations.

In order to determine the content validity of the questionnaire to be used in the research, the opinions of 5 experts in the field of nursing were taken. Experts were asked to give their opinions as "Very Appropriate at All," "Fairly Appropriate," "Slightly Appropriate," "Not Appropriate at All" for each item in the questionnaire. The content validity rate developed by Davis was calculated according to the answers given by the experts. For this content validity rate, it was recommended to have at least three and a maximum of twenty experts, and if the calculated validity rate was higher than 0.80, it was stated that the content validity rate of that item was high (Yurdugül, 2005). Except for the five items in the questionnaire, the content validity ratios of all the items were found to be 0.80 and above and suitable for the study. Five items with a content validity rate of 0.60 were added to the questionnaire by making necessary corrections according to expert opinions. After correction, the content validity ratio for these items was calculated to be 1.00.

Pilot Study

The pilot study was carried out on forty patients who utilized AES for a minimum of 48 hours following their surgical procedures in the departments of orthopedics, neurosurgery, and general surgery, during the period from May 22, 2017, to August 20, 2017. There was no question change in the data collection form after the pilot study. The study excluded forty patients who were part of the pilot study and employed.

Data Collection

Data were gathered through in-person interviews conducted with the patients who used AES for at least 48 hours after surgery in the patient room of orthopedics, neurosurgery, and general surgery departments. The questionnaire was filled out by the researcher in a quiet environment where the interview would not be interrupted, outside the treatment hours, when the patient did not have pain etc. that would make communication difficult. The questionnaire was completed in an average of 20-30 minutes.

The leg size ranges (calf circumference, upper thigh circumference, knee high, thigh high) that were decisive in the selection of the stocking size (x-small, small, medium, etc.) changed according to the brand of the stocking, the brand and / or size was not written on each stocking, and the use of stockings suitable for the leg size of 67.2% of the patients could not be evaluated because the brand and/or size of the stockings worn could not be determined.

Data Analysis

In this study, due to both the dependent and independent variables being categorical, the chi-square test, a non-parametric test, was employed. Frequency and percentage values were given in the cross tables regarding the examined cases. Statistical significance level was taken as 0.05. Analyzes were made in SPSS 22 program.

Ethical Considerations

Ethical approval was obtained from the Gazi University Ethics Committee (documented under number 04, with document date 19.04.2017-E.58134). Additionally, written permissions were acquired from the pertinent units of the Health Research and Practice Center where the study was conducted and written and verbal consent were obtained from the participating patients. A written and verbal informed consent was obtained from the patient who developed a pressure ulcer on the leg associated with AES for the purpose of photographing and using it. The participants were informed that the information obtained from the research would not be used for anything other than scientific purposes. In this study, research and publication ethics have been adhered to.

Results

As seen in Table 1, it was determined that 52.1% of the participants were 61 years and older, with a mean age of 59.68±15.08. Among the patients participating in this study, 61.8% were female, 61% had body mass? index values classified as overweight and above, 67.5% had no formal education or were primary school graduates, 71.2% had chronic illnesses, and 40.7% were hospitalized in the general surgery department (Table 1).

As seen in Table 2, it was determined that 84.3% of the patients used thigh-length stockings, 93.7% had their stocking size determined by the salesperson, and 98.6% did not have their leg measurements

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taken when determining the stocking size. It was determined that 26% of the patients wore AES that were incompatible with their leg measurements. Additionally, it was found that 82% of patients received assistance from relatives in wearing the stockings (Table 2).

Table 3 shows the problems experienced by the patients regarding the use of AES. It was determined that 96.3% of the patients had difficulty in wearing stockings and 37.9% of them had their stockings rolled down. Patients stated that stockings cause heat increase (43.6%), redness (29.6%), sweating (21.7%) itching (19.9%), pain (11,4%) in their legs. In addition, 7.4% of the patients developed stage 1 pressure injury, 0.9% stage 2 pressure injury, and 0.3% stage 3 pressure injury (Table 3).

Table 1. The distribution of the participants' descriptive characteristics (n=351)

Descriptive characteristics	n	%
Age groups*		
18-30	19	5.4
31-40	23	6.6
41-50	41	11.7
51-60	85	24.2
61-70	89	25.4
Age 71 and older	94	26.7
Gender		
Female	217	61.8
Male	134	38.2
Body mass index (BMI)**		
Underweight	13	3.7
Normal weight	124	35.3
Overweight	107	30.5
Obese or extremely obese	107	30.5
Education level		
No formal education	60	17.1
Primary education	177	50.4
Secondary education	58	16.5
Higher education	56	16.0
Chronic illness		
Present	250	71.2
Absent	101	28.8
Department		
General surgery	143	40.7
Orthopedics	132	37.6
Neurosurgery	76	21.7

** Mean age: 59.68±15.08, min:18-max:89*
***BMI Classification: Underweight=16-19; Normal weight=20-25; Overweight=26-30; Obese or extremely obese=31-40; 41 and above*

The development of a stage 3 pressure ulcer during the use of AES is depicted in Picture 1.

As observed in Table 4, a significant difference was found in the occurrence of itching ($\chi2$=8.504, p=0.014) and sweating ($\chi2$=16.281, p<0.001) issues related to stocking usage among different age groups of patients (p<0.05). It was determined that itching and sweating problems were more common in young people, and these problems decreased as age increases (Table 4). In addition, as seen in Table 5, the findings of the study indicated that there was a significant difference in the pain (x2=6.320, p=0.012), curling (x2=18.080, p=0.000), redness (x2=18.145, p=0.000) and stage 1 pressure injury (x2=4.270, p=0.039) problems related to the use of stockings based on the gender of the patients participating in the study. Furthermore, it was determined that female patients exhibited a higher prevalence of pain, curling, redness, and stage 1 pressure injury issues compared to male participants (Table 5).

Table 2. The distribution of participants based on the characteristics of the AES they use (n=351)

Features	n	%
Type of AES currently used		
Knee length	55	15.7
Thigh length	296	84.3
The person who determines the size of the stockings		
Health personnel (Excluding nurses)	19	5.4
Medical company salesperson	329	93.7
Nurse	3	0.9
The method of determining the size of AES		
Estimation without measurement	166	47.3
Measurement of one or both legs circumference	5	1.4
Based on weight, height, or shoe size	180	51.3
Use of proper size stockings		
Compatible	24	6.8
Incompatible	91	26.0
Not evaluated	236	67.2
***Individual helping to put on stockings**	28	7.9
Self-help	48	13.7
Health personnel	22	6.3
Nurse	288	82.0
Relatives		

**More than one option is marked.*

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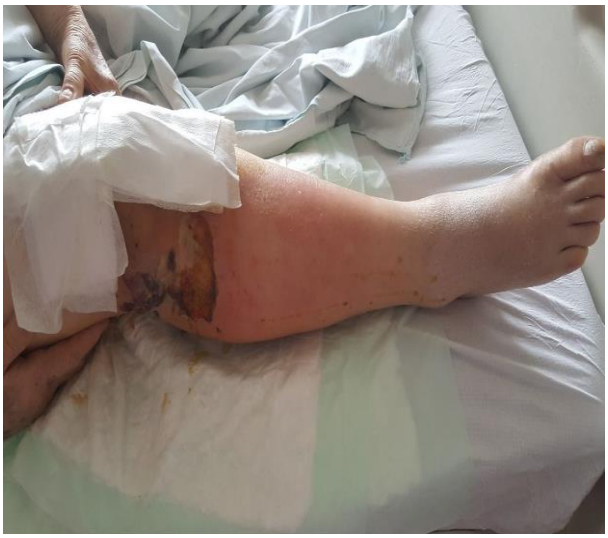
Table 3. The distribution of participants' information needs, practices, and problems related to AES (n=351)

Features	n	%
Getting information about stockings		
Yes	177	50.4
No	174	49.6
Information source about stockings (n=177) *	141	79.7
Health personnel	43	24.3
Previous experiences**		
Topics inquired about AES (n=177) *		
Reason for wearing	119	67.2
Applying, removing, and maintaining stockings	87	49.1
Wearing time	4	2.1
Skin care	1	0.6
The total wearing time of AES		
Three days	206	58.7
Four to six days	106	30.2
Seven days and beyond	39	11.1
Taking off stockings during the day		
Patients removing stockings	64	18.2
Patients not removing stockings	287	81.8
Duration of removing stockings in one day (n=64)		
30 minutes or less	22	34.4
Exceeding 30 minutes	42	65.6
Doing skin care when removing stockings (n=64)		
Yes	26	40.6
No	38	59.4
The method of performing skin care (n=26)	12	46.1
Washing with water	14	53.9
Wiping and applying cream		
The method of washing the stockings		
No wash	337	96.0
Hand washing at low temperature	14	4.0
The method of drying the stockings (n=14)	11	78.6
Air drying	3	21.4
Drying on the heater		
Availability of spare stockings		
Yes	19	5.4
No	332	94.6
Problems*		
Difficulty in wearing	338	96.3
Temperature rise	153	43.6
Curling	133	37.9
Redness	104	29.6
Sweating	76	21.7
Itching	70	19.9
Numbness	42	12
Pain	40	11.4
Stage 1 pressure injury	26	7.4
High cost	8	2.3
Slip down	7	2
Edema	6	1.7
Stage 2 pressure injury	3	0.9
Stage 3 pressure injury	1	0.3

**More than one option is marked.*
***Participants who have themselves or their relatives previously utilized AES*



Picture 1. Stage 3 pressure injury developed during the use of AES after total knee replacement surgery (Written permission was obtained from the patient for the use of photographs)

As observed in Table 4, a significant difference was found in the occurrence of itching ($\chi2=8.504$, $p=0.014$) and sweating ($\chi2=16.281$, $p<0.001$) issues related to stocking usage among different age groups of patients ($p<0.05$). It was determined that itching and sweating problems were more common in young people, and these problems decreased as age increases (Table 4). In addition, as seen in Table 5, the findings of the study indicated that there was a significant difference in the pain (x2=6.320, p=0.012), curling (x2=18.080, p=0.000), redness (x2=18.145, p=0.000) and stage 1 pressure injury (x2=4.270, p=0.039) problems related to the use of stockings based on the gender of the patients participating in the study. Furthermore, it was determined that female patients exhibited a higher prevalence of pain, curling, redness, and stage 1 pressure injury issues compared to male participants (Table 5).

Discussion

DVT can be prevented with pharmacological and mechanical prophylaxis. One of the mechanical prophylaxis methods is the use of AES. Inconsistency with the leg size and incorrect use of the AES cause a decrease in its effectiveness (Collaboration et al., 2009). In this study, it was found that only 1.4% of the patients had their leg measurements taken, while almost all of them (98.6%) had their stocking size determined by estimation based on visual inspection, weight, or height. For AES to be effective, it is essential that they are appropriately sized for the patient. The

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brand and/or size of the AES worn by the majority of the patients (67.2%) could not be determined due to the fact that the brand and/or size of the AES used by the patients were not written on it, and the boxes of the stockings were thrown away by the patient or their relatives. Therefore, the use of stockings suitable for the leg size of these patients could not be evaluated. It was determined that 26% of the patients wear stockings that were incompatible with their leg sizes. Moreover, among the 115 patients whose stocking sizes could be evaluated, it was determined that 79% of patients wore stockings that were not suitable for their leg measurements. (Table 2).

In the study of Munoz-Figueroa and Ojo (2015), it was found that the patients were often dressed in the wrong size of AES that were inconsistent with their leg size (Munoz-Figueroa and Ojo, 2015). Similarly, in the study of Donnelly and McNeely (2015), it was determined that leg measurement was not performed in the majority of patients (Donnelly and McNeely, 2015).

Unlike this study, in the study of Walker and Lamont (2008), it was reported that leg measurements were made in the majority of patients (Walker and Lamont, 2008). Similar to this study, in the study of Winslow and Brosz (2008), the rate of patients whose stocking size was not suitable was found to be 26% (Winslow and Brosz, 2008). In addition, in Miller's (2011) study, it was reported that 36% of the patients wore the wrong size stockings according to the leg size (Miller, 2011). However, in the study of Dirimese et al. (2012), it was determined that the stockings worn by almost all of the patients were the right size (Dirimese et al., 2012). According to the studies conducted, there is often a need for patient education regarding the use of AES (Li et al., 2012; May et al., 2006; Miller, 2011; Munoz-Figueroa and Ojo, 2015; Winslow and Brosz, 2008). Approximately half of the patients in this study reported receiving information about AES. The majority of those who received information cited the reason for wearing stockings, and approximately half mentioned receiving information about the application, removal, and care of the stockings (Table 3). This finding is consistent with the study conducted by Winslow and Brosz (2008), where the majority of patients expressed an understanding of the purpose of wearing stockings, showing similarity with the results of this study.

Table 4. The distribution of patients' problems related to anti-embolism stockings by age groups (n=351)

		Age groups				
Problems*		Young (18-40 years) n (%)	Middle age (41-60 years) n (%)	Elderly (Age 61 and older) n (%)	Total n (%)	Statistical analysis
Itching	Yes	15 (35,7)	26 (20,6)	29 (15,8)	70 (19,9)	$\chi 2$ = 6,320; p = 0,012
	No	27 (64,3)	100 (79,4)	154 (84,2)	281 (80,1)	
Sweating	Yes	17 (40,5)	33 (26,2)	26 (14,2)	76 (21,7)	$\chi 2$=18,080; p = 0,000
	No	25 (59,5)	93 (73,8)	157 (85,8)	275 (78,3)	

** Pearson chi-square test was utilized.*

Table 5. The distribution of patients' problems related to anti-embolism stockings by gender (n=351)

		Gender			
Problems*		**Female n (%)**	**Male n (%)**	**Total n (%)**	**Statistical analysis**
Pain	Yes	32 (14,7)	8 (6,0)	40 (11,4)	$\chi 2$ = 6,320; p = 0,012
	No	185 (85,3)	126 (94,0)	311 (88,6)	
Curling	Yes	101 (46,5)	32 (23,9)	133 (37,9)	$\chi 2$=18,080; p = 0,000
	No	116 (53,5)	102 (76,1)	218 (62,1)	
Redness	Yes	82 (37,8)	22 (16,4)	104 (29,6)	$\chi 2$=18,145; p = 0,000
	No	135 (62,2)	112 (83,6)	247 (70,4)	
Stage 1 pressure injury	Yes	21 (9,7)	5 (3,7)	26 (7,4)	$\chi 2$ = 4,270; p = 0,039
	No	196 (90,3)	129 (96,3)	325 (92,6)	

** Pearson chi-square test was utilized.*

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Similarly, in a study by Donnelly and McNeely (2015), it was reported that most of the patients were informed about the benefits of AES (Donnelly and McNeely, 2015). Unlike our study, in Miller's (2011) study, it was found that the majority of the patients were uninformed about the rationale behind utilizing AES, lacked awareness regarding the potential complications related to AES usage and its recommended duration of wear, and not all of them received written instructions (Miller, 2011). In addition, in the research carried out by Li et al. (2012), it was observed that patients lacked awareness regarding the significance of using AES, exhibited reluctance towards wearing stockings, and did not receive sufficient patient education (Li et al., 2012). Similarly, based on our clinical observations, patients have displayed reluctance to wear AES. The majority of participants who received information about AES reported acquiring this knowledge from healthcare personnel (Table 3). In this study, our clinical observations were that the patients were given verbal information by the healthcare personnel, but not written information, suggesting that the patients had a lack of information due to the fact that verbal information was forgotten over time. In addition, it was thought that the paper containing the instructions for using stockings in the box of the AES sold by the medical personnel was also thrown away by the patient and / or his relatives after wearing the stockings, which was also thought to be effective in the lack of information. Similarly, in the study of Dirimese et al. (2012), it was revealed that the majority of the patients were informed about the use of AES by the health teams and the use of AES was shown (Dirimese et al., 2012).

AES should be removed during day, for a maximum of 30 minutes a day (Autar, 2009; Lloyd Jones, 2013). In the current investigation, it was ascertained that the majority of the patients did not remove the AES at all (Table 3). Likewise, in Miller's (2011) research, it was revealed that most patients did not have to remove the AES for any purpose other than showering (Miller, 2011). Furthermore, the study conducted by Dirimese et al. (2012) demonstrated a similarity with our study in terms of the majority of patients not removing the AES on a daily basis and not performing regular skin inspections (Dirimese et al., 2012). In the study by Akyüz and Tunçbilek (2021), it was found that more than half of the patients did not remove their stockings during their hospital stay before the implementation of the AES maintenance protocol. This result is consistent with our study.

In contrast to the recommended practice, which suggests washing AES every three days or earlier if they become soiled, as outlined in the study by Akyüz and Tunçbilek (2018), it was found that almost all of the patients in this study neither washed their stockings nor had access to spare stockings (Table 3). Similarly, in a study by May et al. (2006), all interviewed patients reported that they did not receive instructions on how to launder the stockings. In Miller's (2011) study, it was found that the majority of patients had dry and clean stockings due to the short duration of use, but those with dirty stockings (18%) were not aware of the washing protocol or the necessity of changing it. Patients not washing their stockings can lead to healthcare-associated infections. Moreover, considering that most patients receive only one pair of stockings, those who do wash their stockings may lose the therapeutic benefit for an extended period (Miller, 2011).

In the literature review, it was determined that the patients had difficulty in wearing, sweating, squeezing, slipping down, curling/tourniquet effect, itching, pain, tenderness, feeling of warmth, edema, pressure injuries, numbness, discomfort related to AES (Akyuz and Tuncbilek, 2021; Dirimese et al, 2012; Miller, 2011; Rathore et al., 2017, Walker and Lamont, 2008). Similar to the literature, the problems experienced by the patients participating in this study included difficulty in wearing stockings, increased heat in the legs, downward curling of the stockings, redness, sweating, itching, slipping, numbness, pain, high cost, edema, and stage 1, 2, 3 pressure injuries (Table 3). Given that 79% of patients whose stocking sizes could be determined in this study wore stockings of incorrect size, it is inevitable for them to experience skin issues related to AES. Similarly, in the study conducted by Walker and Lamont (2008), it was observed during the audit that only 84% of the patients who were provided with stockings actually wore them. Among the patients who wore stockings, 18% reported discomfort associated with the stockings. The reasons cited for the discomfort included feeling too warm, itching, tightness around the calves, excessive tightness, blistering behind the knees, dislike of toes protruding out, and rolling down of the stockings (Walker and Lamont, 2008). In Miller's study (2011), it was noted that 25% of the participants experienced skin constriction below the knee caused by the upper band of the stocking folding or bunching, while in 2.5% of instances, a stage 1 pressure injury was detected on the big toe.

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This finding is consistent with the results of our study. Unlike the studies in the literature, it was found that the patients in this study experienced the highcost problem at a very low rate (2.3%). However, during the study, it was observed that most of the patients used more than one medical equipment and because all the materials were charged on a single invoice, the patients did not know the price of the individual medical equipment. Therefore, it was thought that patients couldn't comment on the cost of AES.

In this study, a statistically significant association was observed between the age groups of the participating patients and the occurrence of itching and sweating issues due to wearing stockings ($p<0.05$). It was determined that more itching and sweating problems were seen in young people, and the incidence of itching and sweating problems decreased as age increased (Table 4). No other study comparing itching and sweating issues related to age groups and AES usage has been found in the literature. Body temperature at rest in the elderly may be lower than in younger adults. In addition, with aging, thermosensitivity decreases, skin vasomotor and sweating responses or threshold values that activate metabolism change. Therefore, responses to thermal problems may be delayed or underreacted (Szekely and Garai, 2018). This explains the reason why older people sweat less than younger people.

A statistically significant correlation was established between the issues of pain, curling, redness, and stage 1 pressure injury, pertaining to the utilization of stockings, with respect to the gender of the study's participating patients ($p<0.05$). The findings indicated that female patients exhibited a higher prevalence of pain, curling, redness, and stage 1 pressure injury issues compared to their male counterparts. (Table 5). Unlike this study, Winslow and Brosz's (2008) research revealed that there was no statistically significant association between skin redness and discomfort based on gender (Winslow and Brosz, 2008). In humans, male skin is thicker than female skin, but females have thicker subcutaneous tissues. Aging results in thinner female skin, especially in postmenopausal women (Dao and Kazin, 2007). In our study, the majority of participants being female between (61.8%) and 76.3% of them being 51 years and older may have contributed to women experiencing more skin problems related to AES.

Nurses should inform patients about the use of AES in order to reduce the problems related to AES (Miller, 2011). However, it was reported in the literature that nurses had insufficient knowledge about the correct practice and usage of AES (Akyuz & Tuncbilek, 2021; Kim & Lee, 2015; Xu et al., 2020). In addition, Kim and Lee (2015) stated that nurses had problems with the practice of AES (Kim & Lee, 2015). In the research conducted by Akyuz and Tuncbilek (2021), the incidences of skin issues, such as pressure injuries, neurovascular problems, and wrinkling problems associated with the use of stockings, exhibited a substantial reduction subsequent to the implementation of the AES care protocol. This study showed that when a care protocol was used, nurses' knowledge and intervention skills increased, along with error prevention and improved patient outcomes (Akyuz & Tuncbilek, 2021).

Limitations of the Research

The research was conducted at a single center and in certain departments. Evaluations were carried out according to the answers given by the patients. Therefore, the data cannot be generalized to all hospitals. Moreover, the leg size ranges (calf circumference, upper thigh circumference, knee high, thigh high) that were decisive in the selection of the stocking size (x-small, small, medium, etc.) changed according to the brand of the stocking, the brand and / or size was not written on each stocking, and the use of stockings suitable for the leg size of 67.2% of the patients could not be evaluated because the brand and/or size of the stockings worn could not be determined.

Conclusion and Recommendations

In this study, it was determined that almost all of the patients did not measure the leg while determining the stockings size, their stockings were never washed during the time they were used, they did not have spare stockings, the majority of them never took off their stockings, and about half of them had knowledge about stockings.

It was found that the main problems experienced by the patients regarding the use of stockings were difficulty in wearing stockings, increased temperature, downward curling of the stockings, redness, sweating, and itching. In order to prevent problems related to AES, it is recommended to develop standard protocols in institutions, to monitor the level of compliance of nurses with the protocols, to apply a regularly updated training program to nurses about the use of AES, and to provide written training materials and training to

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patients who wear AES. It is also recommended to conduct multicenter studies in order to monitor the use of AES and to determine the knowledge, practices and problems experienced by the patients who use AES in the postoperative period.

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What did the study add to the literature?

- This study makes a valuable contribution to the literature by enhancing our understanding of patients' knowledge, practices, and encountered issues regarding the use of AES during the postoperative period.
- It offers insights that can contribute to improving patient care, enhancing patient education, and optimizing the utilization of AES for the prevention of DVT.
- The findings of this study can provide better guidance to healthcare providers for effective utilization of AES and help patients achieve better outcomes during the postoperative period.

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