

# Physicians' and Nurses' Use and Determinants of Mechanical Methods for Prophylaxis of Deep-Vein Thrombosis

## Hekim ve Hemşirelerin Derin Ven Trombozu Profilaksisinde Mekanik Yöntem Kullanımları ve Belirleyicileri

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### ABSTRACT

**Objective:** This study was conducted to determine the use of mechanical methods and determining factors of prophylaxis of deep-vein thrombosis by physicians and nurses.

**Methods:** The study was conducted between December 2020 and February 2021. The participants of this study consisted of 234 physicians and 303 nurses working in surgical and internal medicine clinics/intensive care units of a university hospital in Turkey. Data were collected using forms developed by the researchers and analyzed using mean and standard deviation, number and percentage distributions as descriptive statistics.

**Results:** The mechanical method most used by the physicians and nurses was anti-embolism stockings. Factors determining the use of mechanical methods were routine practices in the clinic, ease of application, suitability for the patient use, presence of devices/materials in the clinics, and preference of the physician. Some of the nurses reported that they had difficulties using mechanical methods (39.3%). These difficulties were as follows: patients' compliance problems related to the use of mechanical methods (38.9%), inability to apply mechanical methods correctly (27.9%), inability to evaluate/monitor it (20.0%), and having trouble with hospital procedures (13.2%). Physicians noticed the wrong/missing use of mechanical methods (57.7%). These were improper application of the mechanical methods (54.1%) and failure to choose the right mechanical method for the patients (22.5%).

**Conclusion:** Considering the guidelines, effective and safe mechanical methods suitable for the patient should be used in clinics. Care protocols should be developed for the use of mechanical methods to standardize care, and health professionals should be trained to provide quality care.

**Keywords:** Deep-vein thrombosis, mechanical methods, prophylaxis, physician, nurse

### Öz

**Amaç:** Bu çalışma, hekim ve hemşirelerin derin ven trombozu profilaksisinde mekanik yöntem kullanımlarını ve belirleyici faktörleri saptamak amacıyla yapılmıştır.

**Yöntemler:** Çalışma Aralık 2020-Şubat 2021 tarihleri arasında gerçekleştirildi. Bu çalışmanın katılımcılarını Türkiye'de bir üniversite hastanesinin cerrahi ve dahiliye klinikleri ile yoğun bakım ünitelerinde çalışan 234 hekim ve 303 hemşire oluşturdu. Veriler araştırmacılar tarafından geliştirilen formlar kullanılarak toplandı ve tanımlayıcı istatistik olarak ortalama ve standart sapma, sayı ve yüzde dağılımları kullanılarak analiz edildi.

**Bulgular:** Hekim ve hemşirelerin en çok kullandığı mekanik yöntem antiembolik çoraplardı. Mekanik yöntemlerin kullanımını belirleyen faktörler klinikteki rutin uygulamalar, uygulama kolaylığı, hastanın kullanımına uygunluğu, klinikte cihaz/malzeme varlığı ve hekim tercihi idi. Hemşirelerin bir kısmı (%39,3) mekanik yöntemleri kullanırken güçlük yaşadıklarını bildirdi. Hemşirelerin yaşadıkları güçlükler; hastaların mekanik yöntem kullanımına bağlı uyum sorunları (%38,9), mekanik yöntemleri doğru uygulayamama (%27,9), değerlendirememeye/izleyememe (%20,0) ve hastane prosedürlerinde sorun yaşamama (%13,2) olarak belirlendi. Hekimler, mekanik yöntemlerin

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yanlış/eksik kullanıldığını fark ettiklerini bildirdi (%57,7). Bu yanlış/eksik kullanımlar mekanik yöntemlerin yanlış uygulanması (%54,1) ve hastalara doğru mekanik yöntemin seçilememesi (%22,5).

**Sonuç:** Kliniklerde kılavuzlar dikkate alınarak hastaya uygun etkili ve güvenli mekanik yöntemler kullanılmalıdır. Bakımı standardize etmek için mekanik yöntemlerin kullanımına yönelik bakım protokolleri geliştirilmeli, kaliteli bakım sağlamak için sağlık profesyonellerine bu doğrultuda eğitim verilmelidir.

**Anahtar Kelimeler:** Derin ven trombozu, mekanik metodlar, profilaksi, hekim, hemşire

## INTRODUCTION

One of the most common complications affecting hospitalized patients and especially those who underwent surgery is deep-vein thrombosis (DVT), which results from venous stasis, vein injury, and increased coagulation, called Virchow's triad venous stasis, vascular injury, hypercoagulability.<sup>1,2</sup> Venous thromboembolism (VTE) due to DVT is an important health problem, with high mortality and morbidity rates worldwide.<sup>3-5</sup> Although the exact number of people affected by DVT/VTE is not known, it is reported that it affects as many as 900 000 people in the United States and that 100 000 people die of blood clot deaths each year. It also causes serious economic losses and social effects.<sup>6</sup> In addition, it is stated that the coronavirus disease, which is currently affecting the world, increased thromboembolic events.<sup>7</sup> Considering the increased risk of VTE in hospitalized patients, it is imperative to consider prophylaxis in patients to prevent DVT.<sup>1</sup> Methods of DVT prophylaxis include pharmacological (standard heparin, low-molecular-weight heparin, fondaparinux, oral anticoagulants etc.) and nonpharmacological mechanical methods [mobilization, range of motion, anti-embolism stockings (AES)/graduated compression stockings (GCSs), intermittent pneumatic compression (IPC) device, venous foot pumps, neuromuscular electrical stimulation].<sup>2,4,8-11</sup> Mechanical methods have been suggested because they counteract most of the components of the Virchow's triad (venous stasis, vascular injury, hypercoagulability) and are not associated with any bleeding risk. Although early and frequent ambulation has been historically advised for preventing VTE, this measure is inadequate per se and frequently not feasible as the sole means of mechanical thromboprophylaxis. Accordingly, additional measures are being used in clinical practice, including graded compression stockings, IPC devices, and venous foot pumps.<sup>9</sup>

In the literature, it has been shown that mechanical methods are effective in VTE prophylaxis when used alone or in combination with other methods.<sup>9,12-14</sup> Overall, mechanical compression methods can reduce the risk of VTE by nearly two-thirds when used as the only form of thromboprophylaxis and by about half when combined with a pharmacological approach.<sup>9</sup> Mechanical methods must be used in cases where the use of pharmacological prophylaxis is contraindicated, such as in patients at risk of bleeding.<sup>10,12,15</sup> In addition, in cases where mobilization is contraindicated (e.g., due to surgery) or in immobile patients (e.g., patients with stroke and unconscious patients), mechanical prophylaxis provides important protection in preventing DVT.<sup>2,16</sup>

Although mechanical methods are very diverse and recommended in guidelines and research results,<sup>10,11</sup> it is reported that they are not applied sufficiently and are ignored.<sup>12,15-18</sup> In a multinational cross-sectional study, it was reported that 51.8% of 68.183 patients were at risk of VTE, while only 50.2% of these patients were treated by prophylactic methods as recommended

by the American College of Chest Physicians.<sup>18</sup> Despite their common use and effectiveness, some challenges, misuses, and misapplications have been reported in the literature regarding the use of mechanical methods. Regarding the frequently used AES, it has been reported that nurses did not receive training on the use and care of it, had problems with all the steps related to the stockings implementation, and made incorrect and incomplete applications.<sup>8</sup> As a result of misapplication, skin problems (redness, pressure sores, etc.) and neurovascular problems developed in patients.<sup>8,19</sup> It is reported that similar problems are seen in IPC applications.<sup>20</sup>

While Caprini<sup>12</sup> stated that studies to identify the optimal mechanical methods and the type of compression for the prevention of DVT are not available, Cohen et al<sup>18</sup> reported that one of the most important steps in ensuring adequate prophylaxis against DVT is encouraging physicians to follow appropriate guidelines. Considering the various risk factors for DVT/VTE among hospitalized patients, nurses, who provide uninterrupted and continuous care, have an important role in the implementation of prophylactic interventions because nurses are often responsible for applying and using mechanical methods and caring for patients.<sup>17,19,21</sup> However, when the literature is examined, we could find few studies on the use of mechanical methods for DVT prophylaxis. On the other hand, in clinics, practice differences are noteworthy, and one of the factors that affect the difference in use is the practitioners. For this reason, examining the physicians' and nurses' use of mechanical methods and the factors determining their use will contribute to the literature and raise awareness.

## AIM

The aim of this study is to determine the use of mechanical methods and determining factors that prevent DVT by physicians and nurses.

## Research Questions

The study sought answers to the following questions:

1. Which mechanical methods do physicians and nurses use to prevent DVT?
2. What are the practices related to the mechanical method used by physicians and nurses?
3. What are the factors that determine the use of mechanical methods by physicians and nurses?

## METHODS

### Research Design

A descriptive research design was used in this study.

### Participants

The participants of this study consisted of physicians and nurses working in surgical and internal medicine clinics/intensive care

units of a university hospital in Turkey. No specific sampling process was performed. We invite all the nurses and physicians who met the inclusion criteria. The study was carried out with a total of 537 participants, including 303 nurses and 234 physicians. A total of 324 nurses and 299 physicians work in these clinics. In the current study, 93.5% of the nurses and 78.2% of the physicians in the sample were reached. Inclusion criteria for the study were as follows: working in the clinics and intensive care units included in the sample (as the nurse orientation period is 2 months, nurses working for 2 months or more are included), volunteering to participate in the study, and being 18 years or older.

### Data Collection Instruments

Data were collected using the “Nurse Data Collection Form” and “Physician Data Collection Form” developed by the researchers based on the literature and clinical observations.<sup>1,4,8,9,10,12,13,15,17,19,20,21,24</sup>

*Nurse Data Collection Form* consists of 2 parts. In the first part of the form, there are 12 questions about the sociodemographic characteristics of the nurses. In the second part, there are 27 questions about the practices and opinions of the nurses, about the use of mechanical methods, and about the factors determining the use of it.

*Physician Data Collection Form* consists of 2 parts. In the first part of the form, there are 7 questions about the sociodemographic characteristics of the physicians, and in the second part of the form, there are 21 questions to examine the practices and opinions of them regarding the use of mechanical methods and the factors determining the use of it.

The expert opinions were obtained from 5 faculty members who are experts in nursing for the validity of the scope of data collection forms. The pilot study was carried out with 20 physicians and nurses. While no questions were added to the data collection forms after the pilot study, 2 questions were removed from the Physician Data Collection Form and 1 from the Nurse Data Collection Form. Two questions in the nurse data collection form were combined into a single question due to their similarity. Structural changes have been made to ensure a better understanding of the sentences in both forms. Participants who were piloted were included in the study.

### Data Collection

The data of the study were collected between December 2020 and February 2021. Data collection forms were given to nurses and physicians, and they were asked to fill in the forms. For participants on duty during the night shift, forms were left to the charge nurse and chef physician to be given to the participants to fill in the form and filled forms were collected from the clinics every morning. Participants who were coronavirus disease positive or on annual leave were listed, checked the date of the return days, and forms have been given to them and data were collected.

### Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences software, version 11.5 software (SPSS Inc.; Chicago, IL, USA). Before analysis, a missing data analysis was conducted, and it was determined that there was no missing data. Quantitative data were analyzed using mean and SD, number, and percentage distributions as descriptive statistics.

### Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by the

Non-Interventional Clinical Research Ethics Committee of Kirikkale University in Turkey (Date: March 4, 2020, Number: 2020.02.04) and application permissions from the hospital management was obtained. Participants were informed of the purpose, procedure, and confidentiality of the study, and written informed consent was obtained prior to participation. An informed consent form containing detailed information about the purpose, scope, and method of the study was given to the participants, whom the researcher did not meet face to face, and their written consent was obtained.

## RESULTS

The mean age of the nurses was 31.08 years (SD: 7.15 years), and 82.2% were female, 86.1% were undergraduate degrees, and 60.1% were working in the surgical clinics/intensive care units. The mean age of the physicians was 33.52 years (SD: 10.31 years), and 66.2% were male, 69.2% were physician assistant, and 52.1% were working in the surgical clinics/intensive care units. A majority of nurses (70.6%) had not received training on mechanical methods (Table 1).

The mechanical method most used by the participants was AES (nurse: 79.7%, physician: 78.7%). Nurses stated that factors determining the use of mechanical methods were as follows: DVT risk assessment results of the patients (28.8%), routine practices in the clinic (21.7%), preference of the physicians (20.7%), ease of application (11.7%), cost-effectiveness (8.1%), and hospital procedures (7.9%). For physicians, it was determined that the factors determining the use of prophylactic methods were sequentially routine practices in the clinic (21.4%), ease of application (19.0%), suitability for patient use (17.0%), presence of devices/materials in the clinics (15.4%), DVT risk assessment results of the patient (12.2%), senior physician's choice (8.2%), and cost-effectiveness (6.8%) (Table 2).

Almost all of the nurses stated that they did not use any guidelines/care protocol regarding mechanical methods in their clinics (96.4%) and that guidelines/care protocols should be used in the clinics (92.7%). Most of the nurses did not receive any written physician order related to mechanical methods (75.6%), and more than half of them did the routine practice when there was no written physician order (56.6%). Some of the nurses reported that they had difficulties using mechanical methods (39.3%). These difficulties were as follows: patients' compliance problems related to the use of mechanical methods (38.9%), inability to apply mechanical methods correctly (27.9%), inability to evaluate/monitor it (20.0%), and having trouble with hospital procedures (13.2%). Nurses reported that the reasons for having difficulties related to mechanical methods were workload and lack of time (32.2%), lack of staff (25.9%), lack of training/information (23.6%), and lack of device/materials in the clinic (18.3%). Some of the nurses thought that mechanical methods were not used correctly in their clinics (21.8%), and the reasons for this were inability to change clinical routines (25.5%), lack of knowledge of nurses (18.2%) and physicians (16.1%), and lack of decision-making authority of nurses (15.3%) (Table 3).

Only 17 physicians do not use mechanical methods for DVT prophylaxis, and they stated that the reasons for this were that the mechanical methods are not effective (58.8%) and the pharmacological method is sufficient for the prophylaxis of DVT (41.2%). On the other hand, 66.2% of the physicians using mechanical methods thought that mechanical methods were effective in DVT prophylaxis, while 25.6% stated that they were undecided. More than half of the physicians reported that they think partially that

**Table 1. Descriptive Features of the Participants**

| Characteristics of Nurse (n = 303)                         | Mean ± SD    | Characteristics of Physicians (n = 234)                         | Mean ± SD     |
|--|--------------|---|---------------|
| Age (years)  | 31.08 ± 7.15 |   | 33.52 ± 10.31 |
| Experience (years)   | 7.78 ± 7.80  |   | 8.35 ± 10.28  |
| Years of employment in the institution (years)             | 6.23 ± 7.31  |   | 5.74 ± 7.96   |
| Gender   | n (%)        |   | n (%)         |
| Female   | 249 (82.2)   |   | 79 (33.8)     |
| Male   | 54 (17.8)    |   | 155 (66.2)    |
| Education level  |              | Title   |               |
| High school  | 10 (3.4)     | Physician assistant   | 162 (69.2)    |
| Undergraduate degree                                       | 279 (92.0)   | Others (physicians, specialist physician, general practitioner) | 72 (30.8)     |
| Master's degree  | 14 (4.6)     |   |               |
| Clinic   |              |   |               |
| Surgical clinics/intensive care                            | 182 (60.1)   |   | 122 (52.1)    |
| Internal medicine clinics/intensive care                   | 121 (39.9)   |   | 112 (47.9)    |
| Received any training for mechanical prophylactic methods? |              |   |               |
| Yes  | 89 (29.4)    |   |               |
| No   | 214 (70.6)   |   |               |

SD, standard deviation.

the most effective mechanical methods were used for patients (56.9%), and they do not give written physician orders (59.0%). More than half of the physicians noticed the wrong/missing use of mechanical methods (57.7%). The wrong/missing use of mechanical methods was improper application of the mechanical methods (54.1%) and failure to choose the right mechanical method for the patients (22.5%). A majority of physicians thought that physicians should decide on the mechanical method to be used for DVT prophylaxis in patients (62.8%) (Table 4).

## DISCUSSION

The risk of developing DVT and related VTE increases in hospitalized patients. Venous thromboembolism is one of the most common but preventable causes of death in hospitalized patients. Only 50% of hospitalized patients receive DVT prophylaxis, and

prevention of it decreases the risk of DVT/VTE, mortality, and morbidity.<sup>1</sup> Mechanical methods are used in all patients with moderate-to-high risk for DVT. Also, they are essential to use in situations where the risk of bleeding exists, and the use of anticoagulants is hazardous.<sup>1,12</sup> These methods are very diverse, and there are studies evaluating and proving their effectiveness. However, there are very limited resources in the literature on which mechanical method is used and how the use is determined or should be determined.<sup>12,15,19,20</sup> Caprini<sup>12</sup> stated that studies to show which type of leg compression device is optimal for DVT prevention are not available, so individual preference, ease of use, and company support are the determining factors. In the current study, it is determined that the mechanical method most used by the physicians and nurses was AES. Nurses stated that factors determining the use of mechanical methods were

**Table 2. Nurses and Physicians' Uses of Mechanical Methods and the Determinant Factors**

| Mechanical Methods Used in the Clinic*    | Nurse n (%) | Mechanical Methods Used in the Clinic        | Physician n (%) |
|---|-------------|--|-----------------|
| AES                                       | 298 (79.7)  | AES  | 211 (78.7)      |
| Ambulation/mobilization                   | 45 (12.0)   | Ambulation/mobilization                      | 40 (14.9)       |
| IPC                                       | 24 (6.4)    | IPC  | 12 (4.5)        |
| Elastic wrap bandage                      | 7 (1.9)     | Elastic wrap bandage                         | 5 (1.9)         |
| <b>Determinant factors*</b>               |             | <b>Determinant Factors*</b>                  |                 |
| DVT risk assessment result of the patient | 199 (28.8)  | Routine practices in the clinic              | 164 (21.4)      |
| Routine practices in the clinic           | 150 (21.7)  | Ease of application                          | 147 (19.0)      |
| Preference of the physician               | 144 (20.7)  | Suitability for the patient use              | 132 (17.0)      |
| Ease of application                       | 81 (11.7)   | Presence of devices/materials in the clinics | 120 (15.4)      |
| Cost-effectiveness                        | 56 (8.1)    | DVT risk assessment results of the patient   | 95 (12.2)       |
| Hospital procedures                       | 55 (7.9)    | Senior physician's choice                    | 64 (8.2)        |
| No idea                                   | 8 (1.1)     | Cost-effectiveness                           | 53 (6.8)        |

AES, anti-embolism stockings; DVT, deep-vein thrombosis; IPC, intermittent pneumatic compression.

\*Participants gave more than 1 answer.

**Table 3. Nurses' Practices and Opinions on the Use of Mechanical Methods (n = 303)**

| Practices and Opinions  | n (%)      |
|---|------------|
| Do you use any guidelines/care protocol regarding mechanical methods in the clinic? |            |
| Yes   | 11 (3.6)   |
| No  | 292 (96.4) |
| Should guidelines/care protocol be used in the clinic?                              |            |
| Yes   | 281 (92.7) |
| No  | 22 (7.3)   |
| Do you receive a written physician order for mechanical methods?                    |            |
| Yes   | 74 (24.4)  |
| No  | 229 (75.6) |
| What do you do when there is no written physician's order?*                         |            |
| I do the routine practice in the clinic   | 145 (56.6) |
| I talk to physician and get him to give a written order                             | 61 (23.8)  |
| I don't do anything   | 33 (13.0)  |
| I evaluate the patient and decide on the appropriate method and apply it            | 17 (6.6)   |
| Do you have difficulty using mechanical methods?                                    |            |
| Yes   | 119 (39.3) |
| No  | 184 (60.7) |
| Which kind of difficulty do you have?*  |            |
| Patients' compliance problems related to the use of mechanical methods              | 74 (38.9)  |
| Inability to apply mechanical methods correctly                                     | 53 (27.9)  |
| Inability to evaluate/monitor it  | 38 (20.0)  |
| Having trouble with hospital procedures   | 25 (13.2)  |
| What are the reasons for having difficulties?*                                      |            |
| Workload-lack of time   | 97 (32.2)  |
| Lack of staff   | 78 (25.9)  |
| Lack of training/information  | 71 (23.6)  |
| Lack of device/material   | 55 (18.3)  |
| Do you think mechanical methods are correctly applied in the clinic?                |            |
| Yes   | 237 (78.2) |
| No  | 66 (21.8)  |
| Why do you think mechanical methods are not applied correctly in the clinic?*       |            |
| Inability to change clinical routines   | 35 (25.5)  |
| Lack of knowledge of nurses   | 25 (18.2)  |
| Lack of knowledge of physicians   | 22 (16.1)  |
| Lack of decision-making authority of nurses   | 21 (15.3)  |
| Physicians are not sensitive to the issue   | 20 (14.6)  |
| Nurses are not sensitive to the issue   | 14 (10.3)  |
| Is it necessary to use another mechanical method other than the method used?        |            |
| Yes   | 174 (57.4) |
| No  | 129 (42.6) |

\*Participants gave more than 1 answer.

**Table 4. Physicians' Practices and Opinions on the Use of Mechanical Methods (n = 234)**

| Practices and Opinions   | n (%)          |
|--|----------------|
| Do you use mechanical methods for DVT prophylaxis?                                       |                |
| Yes  | 217 (92.7)     |
| No   | 17 (7.3)       |
| Why don't you use (n = 17)   |                |
| I think that these methods are not effective for the prophylaxis of DVT                  | 10 (58.8)      |
| I think the pharmacological method is sufficient for the prophylaxis of DVT              | 7 (41.2)       |
| Do you think the mechanical methods are effective in DVT prophylaxis?                    |                |
| Yes  | 155 (66.2)     |
| Undecided  | 60 (25.6)      |
| No answer  | 17 (7.3)       |
| No   | 2 (0.9)        |
| Do you think the most effective mechanical methods were used for patients?               |                |
| Yes  | 78 (33.3)      |
| Partially  | 133 (56.9)     |
| No answer  | 17 (7.3)       |
| No   | 6 (2.5)        |
| Do you give written order for mechanical methods?  |                |
| Yes  | 63 (26.9)      |
| No   | 138 (59.0)     |
| No answer  | 17 (7.3)       |
| I give a verbal order  | 16 (6.8)       |
| Did you notice the wrong/missing use of mechanical methods?                              |                |
| Yes  | 135 (57.7)     |
| No answer  | 17 (7.3)       |
| No   | 82 (35.0)      |
| What was the wrong/missing use?*   |                |
| Improper application of the mechanical method  | 120 (54.1)     |
| Failure to choose the right mechanical method for the patient                            | 50 (22.5)      |
| Develop complications in the patient as a result of not evaluating the mechanical method | 32 (14.4)      |
| Failure to evaluate the suitability of the mechanical method for the patient             | 20 (9.0)       |
| Who should decide on the mechanical method to be used for the patient?                   |                |
| Physician  | 147 (62.8)     |
| Physicians and nurses  | 66 (28.2)      |
| No answer  | 17 (7.3)       |
| <b>Nurses</b>  | <b>4 (1.7)</b> |

DVT, deep-vein thrombosis.

\*Participants gave more than 1 answer.

as follows: DVT risk assessment results of the patients, routine practices in the clinic, preference of the physicians, ease of application, cost-effectiveness, and hospital procedures. Determinant

factors for physicians were sequential routine practices in the clinic, ease of application, suitability for patient use, presence of devices/materials in the clinics, DVT risk assessment results of the patient, senior physician's choice, and cost-effectiveness. Many of these factors are not effective and scientific in determining the mechanical methods suitable for patients' use. In cases where such multiple factors are involved, misuse and difficulties



may occur. Most of the physicians in this study reported that they noticed the wrong/missing use of mechanical methods, and some of the nurses thought that mechanical methods were not used correctly in their clinics. Also, some of the nurses reported that they had difficulties using mechanical methods, and one of the difficulties was the inability to apply mechanical methods correctly. These findings were compatible with the literature.<sup>8,19,20</sup>

Caprini<sup>12</sup> reported that compliance using these devices is a major problem, and until systems have been developed to easily monitor and ensure compliance, these methods will enjoy only limited use. As seen in our study, some of the mechanical methods were used limitedly, while some methods were not used at all. In addition, patients' compliance problems related to the use of mechanical methods was one of the difficulties nurses experienced when using mechanical methods. In the literature, it is stated that patients' compliance with mechanical methods especially for AES and IPC was poor, and this is due to discomfort, itchiness, excessive heat, the potential for neurovascular disorder, and sweating under the inflatable cuffs.<sup>13,20,21</sup> Caprini<sup>12</sup> emphasized that most mechanical method devices in the market have not undergone rigorous testing, and they are often not fitted or used properly. Winslow & Brosz<sup>19</sup> stated that the GCSs were used incorrectly (they were wrinkled, or the gusset was in the wrong place and sized incorrectly), and most of the patients found them uncomfortable. Moran et al<sup>20</sup> reported in their systematic review that incorrect use of IPC causes complications, and these complications included pain associated with compression as well as skin abrasion and contact rash as a result of the cuff rubbing against the skin. It has been reported in the literature that problems related to patient compliance are caused by the incorrect application of mechanical methods. The reasons for the incorrect uses of mechanical methods were the lack of knowledge of practitioners, not using guidelines in clinics, the lack of adequate health-care professionals, the lack of patient education, and the excessive workload.<sup>8,18,21-23</sup> In the current study, nurses reported that the reasons for having difficulties related to mechanical methods were workload, lack of time, lack of staff, lack of training/information, and lack of devices/materials in the clinic. Some of the nurses thought that mechanical methods were not used correctly in their clinics, and the reasons for this were the inability to change clinical routines, lack of knowledge in nurses and physicians, and lack of decision-making authority of nurses. Such misuse, misapplication, and tracking problems cause complications and compliance problems in mechanical methods. It is obvious that systematic and scientific evidence is needed in the determination of the appropriate mechanical method for patients. Health-care professionals need to be educated and knowledgeable in this regard, and patient compliance should also be considered. The lack of training/information for the physician and nurses was one of the reasons for nurses' difficulties with mechanical methods. Moreover, the elastic bandages that the participants stated that they used for mechanical prophylaxis are not included among the mechanical methods used for DVT in the literature. From this finding, it can be assumed that the participants had a lack of knowledge about mechanical methods.

Barp et al<sup>17</sup> reported that in choosing the best care to prevent VTE and overcome the inefficient care practices still performed for hospitalized at-risk patients, nurses must base their decisions on scientific evidence. But when the literature was examined, there were no evidence-based studies on mechanical methods, especially in nursing care. There is a recommendation in the literature

that for the best use of mechanical methods and for providing the best care for the patient's nurses, they should use guidelines or care protocols.<sup>8,19,24</sup> Cayley<sup>25</sup> reported that one of the most important steps in ensuring adequate prophylaxis against DVT is encouraging physicians to follow appropriate guidelines. Guidelines or care protocols will provide standardized care and have a positive impact on patient outcomes. Guidelines are a set of systematically derived statements that help practitioners make decisions about care in specific clinical circumstances. Protocols are an agreed-upon framework outlining the care that will be provided to patients in a designated area of practice.<sup>8</sup> In the current study, almost all of the nurses do not use any guidelines or care protocols regarding mechanical methods in the clinical setting. On the other hand, these nurses thought that guidelines or care protocols should be used. Akyüz & Tunçbilek's<sup>8</sup> study results demonstrated that nurses' knowledge and intervention skills are increased when a care protocol is used, together with the prevention of errors and improved patient outcomes. In the current study, only 17 physicians stated that they did not use mechanical methods for DVT prophylaxis. They reported that the reasons for this were that the mechanical methods are not effective and the pharmacological method is sufficient for the prophylaxis of DVT. On the other hand, more than half of the physicians using mechanical methods thought that mechanical methods were effective in DVT prophylaxis, while some stated that they were undecided. More than half of the physicians reported that they think partially that the most effective mechanical methods were used for patients, and they do not give written physician orders. It is understood from the current study results that there is no standardization of using mechanical methods, and it differs from physician to physician. These differences can be prevented by using the recommended guidelines, and standard practices can be provided. In addition to the use of the guideline, training should be given to health-care professionals, and it should be repeated intermittently in line with the new literature.

In line with the results of this study, it is recommended to carry out practices to increase the knowledge and awareness levels of physicians and nurses regarding the use of mechanical methods, to use guidelines/protocols, to encourage the use of other methods other than routine in line with evidence-based practices, and to carry out further studies so that nurses take a more active role in this process. Supporting and strengthening vascular nursing as a specialty area may contribute to the systematization of nursing care by expanding and directing care possibilities, favoring nurses' autonomy. Also, it can enable nurses to design and implement high-evidence studies specific to mechanical prophylactic methods.

### Limitations

Limitations are noted in this study. The study is limited to the answers given to the data collection forms of the physicians and nurses working in the surgical clinics/intensive care units and internal medical clinic/intensive care units of a university hospital. It cannot be generalized to all physicians and nurses.

**Ethics Committee Approval:** The study was approved by the Non-Interventional Clinical Research Ethics Committee of Kırıkkale University (Date: March 4, 2020, Number: 2020.02.04) and obtained application permissions from the hospital management.

**Informed Consent:** Participants were informed of the purpose, procedure, and confidentiality of the study, and written informed consent was obtained prior to participation.

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