

The Effect of Vibration on Pain and Anxiety During Intravenous Blood Sampling in Adults*

Yetişkin Bireylerde Kan Alma Uygulamasında Vibrasyonun Ağrı ve Anksiyete Üzerine Etkisi

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• This study was presented as an oral presentation at Adnan Menderes University International Health Sciences Congress in 2017.

ABSTRACT

Aim: This quasi-experimental, descriptive study analyzed the effect of vibration on pain and anxiety during venipuncture in adults.

Methods: Data was collected in the Phlebotomy Unit in a University Hospital. The sample consisted of 401 patients randomly selected (control group, n=197; intervention group, n=204) between 18 and 82 years old. The intervention group experienced vibration during venipuncture whereas the control group had the standard phlebotomy procedure. Pain was measured using the Visual Analogue Scale and anxiety was measured using the State Anxiety Inventory. The unit nurse performed venipuncture on cephalic, basilic veins and dorsal veins of the hand to collect the data. Data was analyzed using the chi-square test, the Mann-Whitney U Test, and the Kruskal-Wallis H test.

Results: Using vibration during peripheral intravenous blood sampling on adults does not make a statistically significant difference in pain (p=0.44) or anxiety (p=0.718) levels.

Conclusion: The use of vibration during peripheral intravenous blood sampling does not affect the procedural pain and anxiety levels in adults. However, the device may be used as an alternative non-pharmacological method for patients who experience intense pain during invasive procedures.

Keywords: Anxiety, pain, phlebotomy, vibration.

ÖZ

Amaç: Bu araştırma periferik intravenöz kan alınan yetişkin hastalarda vibrasyon uygulamasının ağrı şiddeti ve anksiyete düzeyine etkisini incelemek amacıyla yarı-deneysel, tanımlayıcı olarak planlanmıştır.

Yöntem: Araştırmanın verileri bir üniversitesi hastanesinin kan alma biriminde toplanmıştır. Araştırmanın örneklemini; 18-82 yaş arasında, gelişigüzel yöntemle seçilen 204 hasta uygulama, 197 kişi kontrol grubunu oluşturmuştur. Araştırma verileri "Görsel Kıyaslama Ölçeği" ve "Durumluk Kaygı Ölçeği" kullanılarak toplanmıştır. Kan alma işlemi sefalik, basilik ve elin dorsal yüzündeki venler tercih edilerek birimdeki hemşireler tarafından gerçekleştirilmiştir. Uygulama grubunda vibrasyon cihazı kullanılmıştır. Kontrol grubu hastalarında ise standart kan alma prosedürü uygulanmıştır. Ağrı puanları ve anksiyete düzeyleri araştırmacı tarafından hesaplanmıştır. Verilerin değerlendirilmesinde; ki-kare, Mann-Whitney-U ve Kruskal Wallis analizleri uygulanmıştır.

Bulgular: Araştırma bulgularına göre; yetişkin hastalarda periferik intravenöz kan alma işlemi sırasında vibrasyon uygulamasının girişim sırasında hissedilen ağrıya (p=0.44) ve anksiyete düzeyine (p=0.718) etkisinin istatistiksel olarak anlamlı olmadığı saptanmıştır.

Sonuç: Yetişkin bireylerde kan alma işlemi sırasında vibrasyon uygulamasının hissedilen ağrı şiddetine ve anksiyete düzeyine etkisinin istatistiksel olarak anlamlı olmadığı, fakat alternatif bir yöntem olarak hastaya sunulabileceği düşünülmektedir.

Anahtar kelimeler: Anksiyete, ağrı, flebotomi, titreşim.

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Venous interventions are a medical procedure causing severe pain and fear in many patients.^(1,2) The relief of patient pain and providing satisfaction are basic rights, and the interest in pain management during invasive procedures has increased recently.⁽¹⁻³⁾ When the literature is examined, topical creams and sprays are used pharmacologically to reduce the pain felt during invasive procedures. There are also non-pharmacologic methods to manage the pain such as distraction, music, acupressure, TENS (Transcutaneous Electrical Nerve Stimulation) applications, hot/cold application, coughing, and vibration techniques.⁽³⁻⁶⁾ However, the effectiveness and the applicability of the methods used in these studies for adults were not sufficient.⁽³⁾ On the other hand, the effects of the pharmacological interventions are not consistent in every individual⁽⁷⁾ because they require a certain time (30-60 min) in intensive hospital environments.⁽⁸⁾ Besides these methods, studies investigate the pain and anxiety of invasive procedures. Using methods such as preparing the patient with a verbal warning, using musical and visual distractions, or using breathing and/or coughing. However, the applicability of these methods are limited in the noisy, intense environments typical of blood collection units and emergency units of hospitals.⁽⁶⁾ The non-pharmacological methods are advantageous because they are cheap, are noninvasive, have no side-effects, and can be performed without the assistance of a nurse. The evaluation of the efficacy of non-pharmacologic methods by nurses with evidence-based studies is necessary and important.⁽⁹⁾

Different components and theories have been used to explain the physiology of pain.⁽¹⁰⁾ In the literature, the benefits from using a device called Buzzy® that causes a vibration effect are striking. With this device, pain is reduced by blocking the severe and burning pain relieving receptors by a secondary stimulation (vibration) based on the door control theory.⁽¹¹⁾ The effect of vibration on pain during venous intervention was investigated in pediatric patients.^(2,12-17) In these studies, the vibration applied groups reported significantly lower pain than the control groups. Individual or combined use of the vibration and lidocaine-containing creams significantly reduces the pain level during intravenous injections,⁽¹⁸⁾ intramuscular injections,⁽¹⁹⁾ and vaccine administration.⁽²⁰⁾ In addition to these invasive procedures, the effect of vibration on the ankle/foot injections of individuals with rheumatic diseases,⁽²¹⁾ and neonatal heel bleeding⁽²²⁾ were investigated. In these studies, vibrations significantly reduced the pain in the legs.

Although the vibration device has been frequently used in pediatric patients, its efficacy has also been studied in adults.^(20,23,24) In a study conducted in Turkey, the effect of vibration on intramuscular injection pain in adults was examined. It was determined that it reduces the pain during intramuscular injection and increases the satisfaction surrounding the injection experience.⁽²⁴⁾ In a study conducted by Baxter et al. (2009) on adults (n = 29), the group subjected to vibration during intravenous intervention reported less pain compared to the control group.

Aim

Nurses need a method that is easy, cheap, and fast to use in invasive applications.⁽²⁾ Some studies evaluate the effect on the pain during invasive procedures in adults using the vibration method.^(21,23,24) However, we found no studies investigating the effect of the intensity and anxiety level during the peripheral intravenous blood sampling (PIBS) procedure. This study attempted to reduce pain or discomfort that may develop during the PIBS attempts and minimize the complications that may be caused by anxiety to provide beneficial results for both healthcare professionals and patients.

Methods

This study is a quasi-experimental and descriptive study conducted with individuals who visited the Phlebotomy Unit in a university hospital in Turkey. Data obtained in the study was evaluated using the Statistical Package for Social Science (SPSS) 15.0 program. The distribution according to the descriptive characteristics of the patients and the homogeneity between the groups were examined using the chi-square test. The Mann-Whitney U Test was used to compare the groups' mean pain and anxiety scores of patients. The Mann-Whitney U test and Kruskal-Wallis H test were used to compare the mean age, gender, educational status, body mass index, and pain and anxiety scores. The number of patients in both groups was found to be in the range of 90% confidence at a significance level of 0.001. The sampling groups were randomly selected from those who met the inclusion criteria of the study and who agreed to participate in the study. The inclusion criteria were that the patients should: be 18 years old or older, have visible or palpable cephalic, basilic veins and dorsal veins of the hand, have a body mass index between 18.5 and 29.9, not have any deformation at the intervention area (burns, lacerations, scarring, inflammation, infection, or erythema), have no allergy history, and not have any visual or auditory disability that prevents their accurate "Visual Analogue Scale" assessment. The experimental (n= 204) and control (n= 200) groups were identified from individuals who met the criterion of the study and agreed to participate in the study. In the control group, 3 patients were excluded from the study due to data inconsistency during the data analysis and the study was conducted with 197 patients. Written approval was obtained from the University Hospital in the Ege region of Turkey and the Ethics Committee of the DEU Non-Interventional Investigations (Decision: 12.05.2016, Decision No: 2016/13-41). The participants included in the study were asked to sign the Information and Approval documents after receiving information about the aim of the study from the researcher.

In both groups, the procedure was applied according to the directions in the 'PIBS Application Guide' in the literature.^(21,25,26) In the experimental group, the procedure additionally used the Buzzy® device for vibration. A visual comparison scale was used to determine pain severity and state anxiety inventory (Only State section of STAI) was used to determine the anxiety level of patient.

Results

The mean age of the patients in this study was 46.67 ± 16.26 . There was no randomization between the groups. When the gender distribution of patients was examined, females were a slight majority (58.8% of the experimental group and 52.3% of the control group). The experimental group weight distribution included 45.1% in a normal weight range (18.0-25.0) and 54.9% slightly overweight (25.1-29.9). In the control group, 34.0% were found to be at a normal weight and 66.0% were slightly overweight. In the experimental group, 27.5% of the patients graduated from primary school and were illiterate, 36.3% were middle school and high school graduates, and 36.3% were university graduates. In the control group, 36.5% graduated from primary school and were illiterate, 33.0% were middle school and high school graduates, and 30.5% were university graduates.

The mean pain score of the patients in the experimental group was 1.53 ± 1.737 and the mean pain score of the patients in the control group was 1.40 ± 1.713 . As a result of the analysis, there was no statistically significant difference between the mean pain scores of the experimental and control groups (MU= 19234, $p= 0.44$).

The mean anxiety score of the patients in the experimental group was 23.62 ± 3.62 , and the anxiety score of the patients in the control group was 23.79 ± 4.75 . As a result of the analysis, there was no statistically significant difference between the mean anxiety scores of the experimental and control groups (MU= 19684.00, $p= 0.7118$).

There was no statistically significant difference between the mean age, body mass index, and educational status of the

Table 1. Findings About the Pain Level of Intervention Group and Control Group According to Demographics

Demographics	Intervention Group			Control Group		
	n	Med (Min-Max)	$\bar{X} \pm SD$	n	Med (Min-Max)	$\bar{X} \pm SD$
Age Group						
18-37	79	1 (0-6)	1.62 ± 1.612	57	1 (0-8)	1.68 ± 1.919
38-57	84	1 (0-8)	1.43 ± 1.845	60	1 (0-8)	1.58 ± 1.985
58-82	41	1 (0-6)	1.59 ± 1.774	80	1 (0-7)	1.05 ± 1.231
			H*=1.748 p=0.417			H*=2.333 p=0.311
Gender						
Female	120	1 (0-8)	1.58 ± 1.708	103	1 (0-8)	1.71 ± 1.808
Male	84	1 (0-8)	1.48 ± 1.787	94	1 (0-8)	1.05 ± 1.541
			M-U*=4763.00 p=0.489			M-U*=3637.50 p=0.002
Body Mass Index						
Normal	92	1 (0-8)	1.71 ± 1.861	67	1 (0-8)	1.73 ± 2.129
Overweight	112	1 (0-6)	1.39 ± 1.624	130	1 (0-7)	1.22 ± 1.432
			M-U*=4660.00 p=0.224			M-U*=4011.00 p=0.343
Education Group						
Primary school or lower level	56	1 (0-5)	1.39 ± 1.659	72	1 (0-7)	1.14 ± 1.367
Middle school or high school	74	1 (0-8)	1.39 ± 1.637	65	1 (0-7)	1.29 ± 1.598
College	74	1 (0-8)	1.78 ± 1.882	60	1 (0-8)	1.82 ± 2.111
			H*=1.973 p=0.373			H*=3.054 p=0.217
Extremity						
Right	140	1 (0-8)	1.43 ± 1.701	138	1 (0-8)	1.44 ± 1.763
Left	64	1 (0-8)	1.77 ± 1.806	59	1 (0-7)	1.29 ± 1.598
			M-U*=3910.50 p=0.131			M-U*=3878.50 p=0.583
Vein						
Hand dorsal vein	7	1 (0-5)	1.86 ± 1.864	12	1 (0-2)	1.00 ± 0.853
Basilic	57	1 (0-5)	1.67 ± 1.796	64	1 (0-8)	1.64 ± 1.905
Sephalic	140	1 (0-8)	1.46 ± 1.715	121	1 (0-8)	1.31 ± 1.663
			H*=0.783 p=0.676			H*=0.980 p=0.613

M-U* Mann-Whitney U Testi H* Kruskal-Wallis H Testi

Table 2. Findings About the Anxiety Level of Intervention Group and Control Group According to Demographics

Demographics	Intervention Group			Control Group		
	n	Min-Max	$\bar{X} \pm SD$	n	Min-Max	$\bar{X} \pm SD$
Age Group						
18-37	79	20-35	24.63±3.83	57	20-45	24.10±4.91
38-57	84	20-38	22.89±3.04	60	20-50	24.63±5.92
58-82	41	20-37	23.17±3.91	80	20-42	22.95±3.38
		H*=12.566 p=0.002			H*=3.721 p=0.156	
Gender						
Female	120	20-38	24.13±3.83	103	20-50	24.17±5.66
Male	84	20-37	22.89±3.17	94	20-38	23.38±3.47
		M-U*=3947.50 p=0.007			M-U*=4765.50 p=0.847	
Body Mass Index						
Normal	91	20-38	24.38±4.22	67	20-49	24.19±5.36
Overweight	112	20-35	23.00±2.90	130	20-50	23.59±4.41
		M-U*=4262.00 p=0.029			M-U*=4141.50 p=0.566	
Education Group						
Primary school or lower level	56	20-35	22.75±3.25	72	20-36	23.11±2.89
Middle school or high school	74	20-38	23.25±3.15	65	20-42	23.57±2.40
College	74	20-37	24.64±4.09	60	20-50	23.96±6.47
		H*=10.380 p=0.006			H*=2.950 p=0.229	
Extremity						
Right	140	20-38	23.57±3.61	138	20-50	23.88±4.86
Left	64	20-35	23.73±3.66	59	20-45	23.59±4.51
		M-U*=4450.50 p=0.938			M-U*=3864.00 p=0.565	
Vein						
Hand dorsal vein	7	20-28	22.28±2.69	12	20-26	22.41±1.97
Basilic	57	20-32	22.89±2.91	64	20-50	24.45±5.68
Sephalic	140	20-38	22.98±3.87	121	20-49	23.58±4.37
		H*=4.568 p=0.102			H*=1.322 p=0.516	

M-U* Mann-Whitney U Testi H* Kruskal-Wallis H Testi

patients and the mean pain scores in either experimental or control groups ($p > 0.05$; Table 1.). When the results were analyzed by gender, there was no difference in the experimental group, whereas the mean pain score of the female patients in the control group was 1.71 ± 1.808 and the mean pain score of male patients was 1.05 ± 1.541 . This score difference was found to be statistically significant ($MU = 3637.50$, $p = 0.002$).

There was a statistically significant difference ($H = 12.566$, $p = 0.002$) between the age and the mean anxiety scores of the experimental group and the highest anxiety level was seen between 18-37 years of age (Table 2.). There was no statistical significance between the age and the mean anxiety score of the control group ($H = 3.721$, $p = 0.156$). The difference of the groups caused by the difference between 18-37 and 58-82 years, and between 18-37 and 38-57 years.

The mean anxiety scores according to gender are given in Table 2. While the female group in the experimental group had a statistically significant higher anxiety level than the male patients ($MU = 3947.50$, $p = 0.007$), there was no statistically significant difference between the gender status and the mean anxiety scores in the control group ($MU = 4765.50$, $p = 0.847$).

On Table 2. patients who were in a normal weight range in the experimental group had significantly higher anxiety levels compared to overweight patients ($MU = 4262.00$, $p = 0.029$). In the control group, there was no statistically significant difference between the mean anxiety scores and the patients' body mass index ($MU = 4141.50$, $p = 0.566$).

A statistically significant difference ($H = 10.380$, $p = 0.006$) was found between the mean anxiety scores and the educational status of the patients in the experimental group ($H = 2.950$, $p =$

Table 3. Kruskal-Wallis One Way Anova Post-Hoc Test for Intervention Group on Age Groups

Age Groups	Test statistics	Standard error	Standard test statistics	Sig.	Adj.sig.
38-57 and 58-82	0.135	10.934	0.012	0.990	1.000
18-37 and 58-82	29.332	11.047	2.655	0.008	0.024
18-37 and 38-57	29.197	8.995	3.246	0.001	0.004

Table 4. Kruskal-Wallis One Way Anova Post-Hoc Test for Intervention Group on Education Groups

Education Groups	Test statistics	Standard error	Standard test statistics	Sig.	Adj.sig.
Primary or lower- middle or highschool	-13.968	10.165	-1.374	0.169	0.508
Primary or lower- College	-32.306	10.165	-3.178	0.001	0.004
Middle or high school-College	-18.338	9.436	-1.943	0.052	0.158

0.229). The mean anxiety score increased as the education level of the patients in the experimental group increased (Table 2.). To examine the difference between the age groups we perform Kruskal-Wallis one way anova test. The difference of the groups caused by the difference between primary or lower education and college education levels (Table 3.)

Discussion

Invasive procedures constitute an important part of the pain experience in people who are hospitalized or who seek medical care for examination purposes. Reducing pain in small invasive procedures is important for the individual responding to painful procedures and influencing healthcare compliance. Although the PIBS is a small invasive procedure, it may also cause pain and anxiety in individuals.^(27,28,29,30) It is the duty of the nurse to minimize the pain felt during invasive procedures and to ensure the comfort of the patient. Providing fast and effective pain control during painful procedures increases the tolerance to pain.⁽¹⁰⁾ In the literature, the vibration device is utilized during painful interventions. The vibration is a non-pharmacological procedure that nurses can perform independently.^(10,3)

The vibration device was used in different sample groups.^(12,13,15-17) In these studies, the vibration groups reported significantly lower pain than the control groups. In addition, the use of vibration significantly reduced pain in pediatric groups,^(18,20) during intravenous administration,⁽¹²⁻¹⁷⁾ intramuscular injection,⁽²⁰⁾ and the heel bleeding procedure in newborns.⁽²²⁾ Furthermore, there are three studies evaluating the effect of vibration on pain during invasive interventions in adult patients. Baxter et al. (2009), Şahin and Eşer (2013), and Rundell et al. (2016) found vibration alleviates the pain in invasive interventions during intravenous injections, intramuscular injections, and the ankle/foot injections of individuals with rheumatic diseases, respectively. In our study, there was no statistically significant difference between the mean pain scores of the experimental and control groups. It is thought that because this study was conducted with generally

healthy volunteers visiting the outpatient clinic, lower mean pain scores were obtained. In other studies, the reported pain scores were relatively higher than our results.^(21,23,24) In a systematic review by Boerner et al. (2015) to investigate studies about painful invasive interventions, exclusion of patients who frequently experience invasive interventions and high level pain affects the generalizability of the study results. It has been proposed that more detailed studies should be planned for the individuals who are anxious because of the frequent exposure to invasive procedures and those with lower pain tolerance.^(31,32)

The cause of anxiety is very important data in the studies evaluating the efficacy of the pain control interventions.^(24,30) In our study, there was no statistically significant difference between the experimental and control groups mean anxiety score levels during the PIBS procedure. Baxter et al. (2009) found that using vibration for anxiety management was effective in adults during peripheral intravenous catheterization. Another study by Baxter et al. (2011) reported that the experimental group had fewer complaints compared to the control groups.

Buzzy® is a device that can be used repeatedly for children and adults that uses vibration to relieve painful anxiety.⁽³⁰⁾ In studies conducted with pediatric groups, vibrations^(12,20) and distracting stimuli^(13,31) are effective against anxiety. On the other hand, the results of acupressure administration⁽³⁰⁾ and vibration administration⁽¹⁹⁾ during blood transfusion have no effect on patient anxiety level. In addition relaxation of the individual prior to the blood draw procedure were effective methods to control anxiety in patients.⁽²⁸⁾

There was no statistically significant difference between the mean age and pain scores of the experimental and control groups. The systematic study by Lautenbacher et al. (2017) did not find correlation between age and pain. However, they found that elderly patients had a higher pain tolerance against lower-level pain, perhaps because pain decreases with age. In our study, the mean pain scores of patients who were in the 58-82 age group were lower than the other age groups in both

the experimental (1.59 ± 1.77) and control groups (1.05 ± 1.23). In the literature, both elderly and young adults have similar pain tolerance levels.⁽³¹⁾

According to our results, the pain scores in the experimental group did not differ between males and females. When the gender-based mean pain scores were analyzed in the control group, females reported higher pain scores. Similarly, females have lower pain thresholds than males in the literature.⁽¹⁰⁾

No statistically significant difference was found between the mean pain scores and the body mass index (BMI) of the patients in the experimental and control groups. Şahin and Eşer (2013) found that individuals with higher BMI report higher pain than those with lower BMI during intramuscular injection. The presence of nerve endings that receive pain sensation in the subcutaneous tissue and the administration of the drug into the subcutaneous tissue instead of the muscle tissue due to subcutaneous tissue thickness may cause more pain in overweight individuals.⁽²⁴⁾ On the other hand, in a study by Tashani et al. (2017) investigating the relationship between BMI and different pain stimuli (temperature, cold, and pressure), obese individuals had lower pain scores against pressure-type pain. Increased adipose tissue promotes anti-inflammatory cell growth and consequently individuals with high BMI may be less susceptible to pain.^(33,34)

No statistically significant difference was found between the mean pain scores due to the educational status of the patients in the study. Şahin and Eşer (2013) reported that education level affected the intramuscular injection pain score in the experimental group and the pain score increased as the education level increased. Likewise, Birgili and Aydın (2011) also found the pain level reported during the blood draw process increased with the education level of the individuals. Similarly, we observed that those with higher education levels had higher pain scores.

No statistically significant difference was found between the mean anxiety scores and age in the control group, but there was a statistically significant difference between the age groups and the mean anxiety scores of the patients in the experimental group. The highest level of anxiety was found in the 18-39 age range. Some studies found the anxiety level during injection and blood collection was not related to age.⁽³⁵⁾ However, Nir et al. (2003) and Deacon and Abramowitz (2006) reported that young adults experience more anxiety during intravenous treatment than older adults.^(35,36)

In the control group, there was no statistically significant difference between gender and the mean anxiety scores. The difference between the gender and the mean anxiety scores in the experimental group was statistically significant, and females had higher anxiety levels than males. Similar to the results of this study, Nir et al. (2003) and Patel et al. (2014) reported that the anxiety level of females was higher than males during

painful procedures.^(35,37) On the other hand, there are studies in which the anxiety levels during intravenous interventions were not related to the gender of the individuals.⁽³¹⁾ Although there was no statistically significant difference between the mean anxiety scores and the body mass index of the patients in the control group, the normal weight subjects experienced more anxiety than the overweight subjects in the experimental group. Bayram and Çalışkan (2013) found that the level of anxiety in intravenous interventions was not related to BMI.

When the correlation between the mean anxiety score and the educational status of the patients were analyzed in the experimental group, the mean anxiety score increased as the level of education increased. In the control group, no statistically significant difference was found between the mean anxiety scores and the educational status of the patients. No correlation was found between the mean anxiety scores and the educational status of individuals during intravenous interventions and invasive interventions. In addition, individuals with lower educational status reported higher level of anxiety.

Conclusion

This study was conducted to investigate the effect of vibration on pain and anxiety levels in adult patients undergoing intravenous blood sampling. The effect of vibration on pain and anxiety level felt during peripheral intravenous bleeding was not statistically significant. Females in the control group reported higher level of pain than males in both groups, and the females in the control group reported significantly higher levels of severe pain than males. In the experimental group, female patients who were 18-39 years of age, at normal weight, and highly educated had significantly higher anxiety levels than male patients who were 40-82 years, slightly overweight, and less educated.

Suggestions:

- Planning of studies comparing the use of vibration application with other methods to reduce pain intensity and anxiety level
- Evaluating the use of vibration with repetitive measurements such as pre- and post-tests keeping similar sampling groups,
- Studies to reduce pain and anxiety in invasive procedures may be studied in groups subjected to frequent invasive interventions and experiencing high-intensity pain.

Study Limitations

Because the study was conducted at the Phlebotomy Unit in a University Hospital that has a high circulation, the sampling area of this study was limited to the individuals aged 18-82 years who can assess pain using the Visual Analogue Scale. Another limitation of the study was that randomization could not be achieved for the patients who visited the unit for diagnosis and treatment purposes.

Acknowledgement: Thankfull for clinical nurses of University hospital Phlebotomy Department who support our research, and the individuals participating in the research.

Teşekkür: Araştırmanın verilerinin toplandığı üniversite hastanesi kan alma biriminde çalışan hemşirelere ve araştırmaya katılan bireylere teşekkür ederiz.

Ethics Committee Approval: Ethics committee approval was received for this study from the Dokuz Eylül University Nonexperimental Researches Ethics Committee. (date: 12.05.2016 and number: 2016/13-41).	Etik Komite Onayı: Bu çalışma için etik komite onayı, Dokuz Eylül Üniversitesi Girişimsel Olmayan Araştırmalar Etik Kurulu'ndan alınmıştır (Karar tarihi: 12.05.2016 ve Karar No:2016/13-41).
Informed Consent: Taken verbally and in writing from patients who participated in our research.	Bilgilendirilmiş Onam: Çalışmamıza katılan bireylerden sözel ve yazılı olarak alınmıştır.
Peer-review: Externally peer-reviewed.	Hakem Değerlendirmesi: Dış bağımsız.
Conflict of Interest: None	Çıkar Çatışması: Bulunmamaktadır.
Financial Disclosure: None	Finansal Destek: Bulunmamaktadır.

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