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The effect of new device on pain and comfort levels in individuals undergoing peripheral intravenous cannula insertion

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Abstract

Aim and objectives: The purpose of this study is to see how ShotBlocker® affects the pain and comfort level associated with short peripheral intravenous cannula (PIV) insertion.

Methods: The study was conducted on a single sample group using a pre-post design. Individuals in the sample group who underwent a brief PIV insertion procedure served as both the study's control and intervention groups. In the sample group, the same nurse inserted a peripheral intravenous catheter into the cephalic veins of the right and left forearms using a standard insertion and ShotBlocker®. The pain and comfort levels were assessed using the VAS and Comfort Scale.

Results: When the distribution of the average pain and comfort scores of the individuals treated with the peripheral intravenous catheter was examined, it was found that the average pain score of the peripheral intravenous catheter insertion using ShotBlocker® was statistically significantly lower than the peripheral intravenous catheter insertion using the standard method, and the comfort score averages were statistically higher. When the correlation between the pain and comfort score averages of individuals undergoing peripheral intravenous catheter insertions was investigated, a statistically significant and strong negative relationship ($p = 0.001$) was discovered.

Conclusions: As a result, the use of ShotBlocker® during the short PIV insertion procedure is an effective method to reduce the pain caused by the peripheral intravenous catheter. It was determined that the comfort level of the individuals increased as the pain due to peripheral intravenous catheter insertion decreased.

Keywords
Catheters, nurses, nursing care, pain, patient

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Background

Intravenous (IV) catheter insertion is one of the most common invasive procedures used in patients admitted to the hospital. An IV catheter is required for fluid and medication administration, total parenteral nutrition delivery, hemodynamic monitoring, and diagnostic insertions.[1,2]

Short PIV insertions are a nursing intervention that is decided based on the patient's condition, diagnosis, and treatment and are routinely and frequently used, causing pain in the individual.[3,4] PIVs are defined as catheters whose tip is located in the venous system and based on their length, can be classified as follows: (a) short PIV (<6 cm): Maybe further classified as "simple" or "integrated," based on their design and material; (b) long peripheral catheters (LPC) (6–15 cm); (c) midline catheters or "midclavicular" (MC) (>15 cm).[5,6] In the last decade, it has become evident that though PIV—and in particular short PIV, which is by far the most commonly used—may be somehow inexpensive, easy to insert and easy to remove, they are nonetheless associated with a high incidence of minor complications, which all concur eventually to the same outcome, "catheter

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Figure 1. ShotBlocker® (www.bionix.com).

failure," that is, the forced, unscheduled removal of the PIV.[5] When choosing a venous catheter, the patient's characteristics, duration of treatment, type/size of the catheter, place of insertion, and possible complications should be taken into account by practitioners.[7,8] Nurses are responsible for using the best techniques during catheter selection and insertion and following the catheter appropriately.[9,10] A short PIV's lifespan is influenced by factors such as the patient's age, multiple device insertion attempts, catheter gage, and anatomical insertion position. Furthermore, the Infusion Therapy Practice Standards advocate for catheter removal only when clinically necessary.[8] Every patient who requires infusion therapy has a unique set of circumstances, but they all have the same goals. Regardless of national identity, cultural practices, or distinguishing characteristics, all patients want a safe, effective, and comfortable treatment that is delivered in a caring and respectful manner. Some non-pharmacological methods are used in this context to reduce pain during short PIV insertion. Local cold insertion in short PIV applications has been shown in studies to reduce patients' average pain score.[11,12] ShotBlocker®, invented by James Huttner, is another method for pain control. It is a small, flexible, drug-free plastic device with a central hole for injection insertion and several short, blunt skin contact points on the underside. (Figure 1). ShotBlocker® is applied directly to the skin prior to injection.[13] The contact points do not pierce the skin and serve as the stimulus for Melzack and Wall's door control theory.[14] It was intended to reduce needle pain by applying pressure to large area (A beta) fibers, thereby preventing pain transmission along a smaller area (A-delta and C) fibers.[15] The majority of published studies examining the effects of ShotBlocker® on reducing intramuscular (IM) injection pain were conducted with children[4,16] and with recent studies using adults.[17]

With the assumption that skin stimulation using ShotBlocker® will be effective on all body areas even if their anatomical structures are different, it is predicted that the use of ShotBlocker® can also reduce the pain experienced in short PIV procedures.

Furthermore, regional pain occurs as a result of the invasive procedure used, and this pain is thought to affect the individual's overall comfort. As a result, the study's goal is to determine the effect of ShotBlocker® use on the level of pain and comfort associated with people who have intravenous catheters.

Materials and methods

Study type and place

This study, which is an experimental study with a pre-post design, was conducted in a university hospital between 02.03.2020 and 15.12.2020.

Study population / environment

The study included a single sample group. The individuals in the sample group constituted both the control and intervention groups of the study. Of the 176 individuals in the population, 100 individuals who met the inclusion criteria were included in the study conducted ($\alpha = 0.05$, $\beta = 0.10$ and $1\text{-}\beta = 0.90$). In the clinic, the specified short PIV is used to administer peripherally compatible drugs and fluids. Simultaneously, the patients' medications are mixed with these liquid-based treatments and administered to them. In the event that the catheter becomes dislodged or needs to be changed due to infection, the pain and comfort were evaluated by inserting a second catheter on the inner surface of the same patient's contralateral forearm.

Inclusion criteria

1. Speaking and understanding Turkish.
2. Volunteering to participate in the study and giving a written consent form.
3. Being between the ages of 18 and 65.
4. Having no sensory-motor deficit, diabetes, peripheral vascular disease, or neuropathy,
5. Wound, burn, scar tissue, etc. on the skin surface.
6. Short PIV will be applied from the forearm.
7. Not receiving oral or parenteral analgesic treatment before administration.
8. Not receiving chemotherapy treatment.
9. Those who have not had a fistula or mastectomy.
10. Have orientation in place and on time.
11. Having no vision and hearing problems.

Data collection tools

The data was collected using the Personal Information Form, the Visual Analog Scale (VAS), and the Comfort Scale. Based on the literature, the researchers developed this form, which consisted of four components that collected information on the individuals' age, gender, and body mass index. The two end definitions of the parameter to be evaluated are written on both ends of a 10 cm line, and the individual is asked to draw a line, mark a point, or mark a sign to indicate their pain status to the appropriate

Hand washing is applied to minimize the risk of infection.
The identity of the patient is checked.
Permission is obtained from the patient for the procedure.
The appropriate position is given to the selected area.
Gloves are worn.
Remove the short PIV catheter from the outer sheath and the side handle sections are brought to a horizontal position.
The tourniquet is tied 10-12 cm above the selected vein. İnsertion site should be below heart level
After the vein is felt by palpation, clean the area with a baticon or 70% alcohol and wait for 5 seconds to dry.
The needle is held to form an angle of 30-45 degrees to the skin about one centimeter below the area where it is desired to enter the vein, as soon as the needle enters the hole, it is advanced into the vein by reducing the angle to about 15 degrees.
When the needle enters the vein, blood fills into the cannula. Gently advance the needle into the vein.
Releasing the hand under the arm, the needle is retracted one centimeter with the inactive hand. If blood is coming, the needle is in the lumen of the vein. The plastic part is advanced slowly into the vein.
The tourniquet is dissolved with the inactive hand without moving the angiocate in the vessel.
The needle of the injector with saline solution is completely removed. By removing the needle of the angiocat, the injector tip is inserted. While performing the placement process, "V technique" should be applied.
Serum physiology is given slowly. While administering the medicine, it is checked whether there is any swelling, redness and pain in the area.
After the physiological saline is given completely, the angiocath is fixed on the skin with tape.
Remove the syringe from the angiocate and attach the angiocate cap.
Angiocath is fixed on the skin with tapes. The time and date of installation are necessarily written on it.
Contaminated material is removed from the environment.
The insertion, its observations and abnormal findings are recorded.

Figure 2. Intravenous administration protocol.

point on this line, and the scale is scored from 1 to 10.[18] The researchers devised a 10-cm-long horizontal comfort scale that begins with "being most comfortable" and ends with "being most uncomfortable." On a scale of 1–10, participants were asked to rate the most comfortable and the most uncomfortable situation.

Administration of the data collection tools

Before starting the study, approval was obtained from the Clinical Research Ethics Committee and then from the center where the insertion was performed. A thin-walled, radiopaque lined, silicone Luer lock closed, disposable stainless-steel silicon-tipped needle, soft fixation wings, and hydrophobic blood holder with a 22 gauge 0.5×25 mm blue cannula were used in all short PIV insertions. All short PIV insertions were performed by the same nurse working in the placement department, and ShotBlocker® insertion was performed by the researcher to reduce pain (Figure 2). Short PIV was placed in the sample group using the right forearms cephalic vein with the standard application, and then pain and comfort levels were determined using the VAS and Comfort Scale. During the second short PIV placement required by the patient, ShotBlocker® was fixed with a plaster 2 cm above the area to be intervened and was applied to the left arm of the patient through the cephalic vein of the forearm. A different ShotBlocker® was used for each patient. Then, pain and comfort levels were determined using the VAS and Comfort Scale (Figure 3).

Ethical consideration

The Helsinki Declaration 2008 Principles were followed throughout the study, and the Sivas Cumhuriyet University Faculty of Medicine Clinical Research Ethics Committee (Decision No: 2020-02/04) as well as institutional permission were obtained at the outset. The researcher began collecting study data after informing the individuals who would be included in the study and obtaining their informed consent. Individuals were assured that the decision to participate in the study was entirely their own, that the data obtained from this study would be used only within the scope of the research, and that confidentiality would be strictly adhered to.

Data analysis

The study data was analyzed, and tables were created using IBM SPSS Statistics Version 20.0 (IBM, Inc., Armonk, NY, USA). Descriptive statistics and frequency distributions of demographic data are provided in the statistical analysis. The Wilcoxon test was used to identify the measurement or measurement groups that made a difference after the significance was determined, the Mann Whitney U test was used to investigate gender differences,

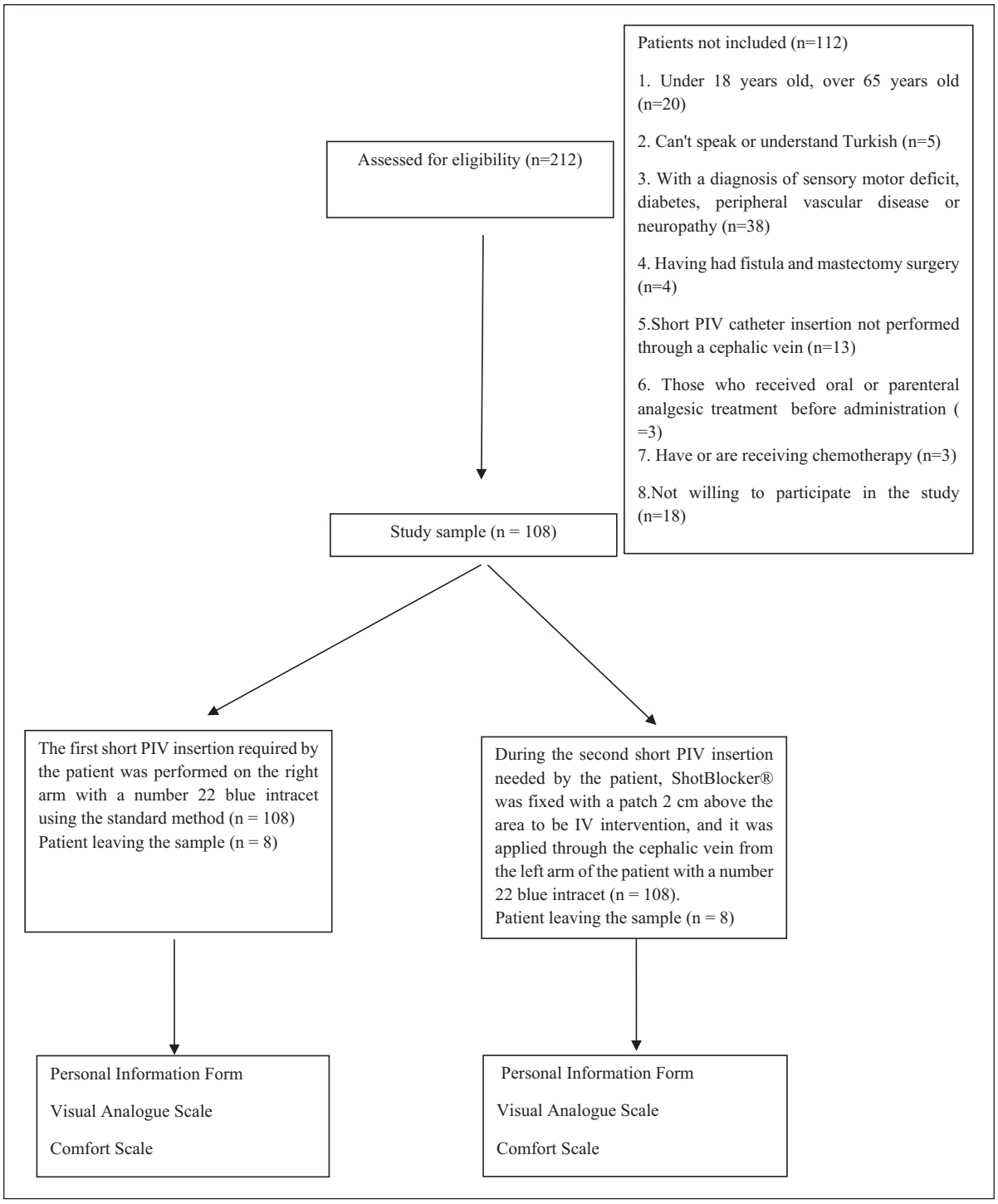

Figure 3. Flow chart of the study.

and the Spearman Rank Correlation coefficient was used to determine the relationship between the variables.

Results

According to the findings of this study, 54.0% of the sample was female, while 46% was male. It was found that 40% of the people in the sample were between the ages of 51 and 65, and a BMI of 66.0% was between 18.5 and 24.9 kg/m^2 (Table 1).

Table 2 depicts the distribution of pain and comfort scores following short PIV placement. There was no statistically significant difference in pain and comfort scores, gender, age, or BMI values after a short PIV placement

Table 1. Socio-demographic characteristics of individuals.

Characteristics	N (%)
Gender	
Female	54 (54.0)
Male	46 (46.0)
Age ($X = 41.53 \pm 14.77$)	
18–34	27 (27.0)
35–50	33 (33.0)
51–65	40 (40.0)
Body mass index (kg/m^2) ($X = 24.2$ kg/m$^2 \pm 2.8$)	
18.5–24.9	66 (66.0)
25.0–29.9	31 (31.0)
30.0–34.9	33 (33.0)

($p > 0.05$). When the distribution of the average pain and comfort scores of the individuals treated with short PIV was examined, the average pain and comfort score of the short PIV insertion using ShotBlocker® was 2.0 (0.0, 4.0) and 8.00 (5.0, 10.0), respectively, while the average pain and comfort score of the short PIV insertion using the standard method was 6.0 (5.0, 8.0) and 6.0 (4.0, 7.0) it was found to be (Table 2) ($p < 0.001$).

When the correlation between the pain and comfort score averages of individuals undergoing short PIV insertions was examined, a relationship was discovered in both the ShotBlocker® group ($r = -0.73$, $p = 0.001$) and the standard insertion group ($r = -0.74$, $p = 0.001$), and the relationship was statistically significant and strong. It has been determined that as individuals' pain levels decrease as a result of short PIV insertion, their comfort level rises (Table 3).

Discussion

The insertion of a short PIV is a nursing intervention that is routinely and frequently used, causing pain in the individual.[1,3,12] Individuals in the sample comprised both the intervention and control groups of the study due to factors such as pain being an individual and unique experience, pain beliefs and methods of coping with pain, and being influenced by socio-cultural and cognitive characteristics.[19] Before and during painful procedures, the American Society for Pain Management Nursing recommends optimal pain control.[18] To control pain, both pharmacological and non-pharmacological approaches are recommended.[8] Studies have found that local cold application in short PIV insertion reduces the average pain score of patients.[11] When studies evaluating the effect of ShotBlocker® insertion on pain control in the literature are examined, Çelik and Khorshid (2015) reported that applying ShotBlocker® during IM injection to the ventrolateral area was effective in reducing IM injection pain.[20]

Aydin and Avşar (2019)[16] discovered that using ShotBlocker® during IM injection into the ventrolateral area resulted in statistically significantly lower pain scores. In their study to evaluate the effects of subcutaneous heparin injection on ecchymosis, pain, and patient satisfaction, Inangil and Şendir (2020)[21] discovered that mechano-analgesia and cold application were effective in reducing injection pain and increasing patient satisfaction. When the distribution of the average pain scores experienced by the patients included in the study after short PIV insertions is examined, the difference between the average pain scores of the short PIV insertion using ShotBlocker® and the average pain score of the standard method is found to be statistically significant. ($p < 0.05$). Similarly, the difference in average comfort measurement scores between ShotBlocker® and the standard method of short PIV insertion was found to be statistically significant ($p = 0.05$). Thus, it has been observed that the use of ShotBlocker® in short PIV insertion decreases the pain experienced by individuals due to IV intervention and therefore increases their comfort levels.

The average pain scores of the short PIV insertion using ShotBlocker® and the level of comfort measurement were found to have a statistically significant and negative correlation in this study ($r = -0.73$). When looking at the relationship between the average pain scores of the short PIV insertion using the standard method and the average scores of comfort measurement, a statistically significant and negative relationship was found ($r = -0.74$). When the pain measurement scores of the patients' decrease, the comfort measurement scores increase. More information and evidence are needed for the use of ShotBlocker® during short PIV insertion to ensure patient safety and standardization of insertions.

Limitations

This study has several limitations:

1. This research was conducted in the units of a single university hospital.
2. The small sample size is a limitation of the study.
3. The sample size may not be large enough to control for patient-related variables.
4. Researchers and patients are not blind to the type of device used.

Conclusions

Short PIV placement is a nursing intervention that is routinely repeated and frequently applied and causes pain in the individual. It is very important to use non-pharmacological methods at the point of providing pain control and therefore increasing the comfort level of the patients. It has been determined that the use of ShotBlocker® reduces the pain experienced by individuals during short PIV and increases the comfort level. There is no national

Table 2. Distribution of post short PIV insertion pain and comfort scores according to.

Characteristics	Pain score of short PIV insertion using ShotBlocker® median (min-max)	Short PIV insertion using standard method pain score median (min-max)	Short PIV insertion using ShotBlocker® Comfort Score Median (min-max)	Short PIV insertion using standard method comfort score average median (min-max)
Gender				
Female	1.5 (0.0, 4.0)	6.0 (5.0, 8.0)	9.0 (5.0, 10.0)	6.0 (4.0, 7.0)
Male	2.0 (0.0, 4.0)	6.0 (5.0, 7.0)	8.0 (5.0, 10.0)	5.5 (4.0, 7.0)
Test result (*p*)	$p=0.26$	$p=0.84$	$p=0.36$	$p=0.45$
Age				
18–34	1.0 (0.0, 4.0)	6.0 (5.0, 8.0)	8.0 (7.0, 10.0)	6.0 (4.0, 7.0)
35–50	2.0 (0.0, 4.0)	6.0 (5.0, 7.0)	8.0 (6.0, 10.0)	6.0 (4.0, 6.0)
51–65	1.0 (0.0, 4.0)	6.0 (5.0, 8.0)	8.0 (5.0, 10.0)	5.5 (4.0, 7.0)
Test result (*p*)	$p=0.22$	$p=0.36$	$p=0.32$	$p=0.62$
Body mass index (kg/m^2)				
18.5–24.9	2.0 (0.0, 4.00)	6.0 (5.0, 8.0)	8.0 (5.0, 10.0)	6.0 (4.0, 7.0)
25.0–29.9	1.0 (0.0, 4.0)	6.0 (5.0, 8.0)	8.0 (5.0, 10.0)	6.0 (5.0, 7.0)
30.0–34.9	1.0 (0.0, 3.0)	6.0 (5.0, 6.0)	8.0 (6.0, 8.0)	5.0 (4.0, 7.0)
Test result (*p*)	$p=0.90$	$p=0.39$	$p=0.28$	$p=0.56$
Short PIV insertion	2.0 (0.0, 4.0)	6.0 (5.0, 8.0)	8.0 (5.0, 10.0)	6.0 (4.0, 7.0)
Test Result (*p*)	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$

Table 3. Correlation status between pain and comfort scores in short PIV insertions.

		Standard insertion comfort	ShotBlocker® comfort
Standard practice pain	*r*	−0.73	−0.76
	p	<0.001*	<0.001*
ShotBlocker® Practice Pain	*r*	−0.79	−0.74
	p	<0.001*	<0.001*

Note: r, Pearson Correlation.
*Correlation is significant at the 0.01 level (two-tailed).

or international study using ShotBlocker® on short PIV. The use of ShotBlocker®, the prominence of the concept of quality in short PIV, and the spread of evidence-based practices all contribute to improved service quality, patient satisfaction, and comfort level. All healthcare professionals, particularly nurses, should be made more aware of the effectiveness of various methods in reducing pain and increasing comfort in short PIV applications. The efficacy of non-pharmacological methods for pain control in short PIV applications should be tested in different groups.

Authorship

All authors of this article have agreed on the final version of this paper and have met all the following criteria: substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data, drafting the article or revising it critically for important intellectual content.

Declaration of conflicting interests

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