Open Access ©2025 The Author(s). Published by College of Nursing, University of Baghdad. This open-access article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INJNS (38)1 (2025) 38-51

Iraqi National Journal of Nursing Specialties

Journal homepage: https://injns.uobaghdad.edu.iq/index.php/INJNS

Research Article Open Access

Efficacy of Shot-Blocker in Alleviating Peripheral Intravenous Cannulation Associated Pain among Hospitalized School-Aged Children

Salsabeel A. Naser MSc.*; Sadeq AL-Fayyadh, Ph.D.**.

* Wasit Governorate Health Directorate, Ministry of Health, Iraq.

E-mail: salsabeel.alaa2204m@conursing.uobaghdad.edu.iq

** Department of Adult Nursing, College of Nursing, University of Baghdad, Baghdad, Iraq.

E-mail:

ARTICLE INFO

Article History:

Received: 05/06/2024
Accepted: 04/08/2024
Published: 30/6/2025

Keywords:

Emergency department,
Intravenous cannulation,
Pain,
Shot-Blocker,
Nurses.

ABSTRACT

Objective(s): Examining the effect of Shot-Blocker in reducing Peripheral Intravenous Cannulation (PIV) associated pain among school age children's patients.

Methods: This study used a prospective, comparative, randomized controlled trial design. The study involved 153 school aged children (6-12 years) who received intravenous cannulation at Emergency Departments in Wasit: Al-Azizia and Al-Numaniyah General Hospital between January 22nd, and February 21st, 2024. Patients were randomly divided into two groups: the Shot-Blocker group (n=79), and control group (n=74). The Peripheral Intravenous Cannulation process was followed by a request for the patients to rate their level of pain using the Wong–Baker Faces Pain Scale. The primary outcome was to reduce pain related to intravenous cannulation for school age children. A descriptive and inferential statistical measures were employed in the analysis of the data through the using IBM-SPSS. The group's differences in levels of pain were measured using an independent sample t-test.

Result: There are statistically significant differences in pain intensity between the Shot-Blocker, and control group (P-value=0.001*). When compared to the control group, Shot-Blocker group showed a markedly reduced pain intensity (mean difference 1.74684). In addition, there were higher pain levels noted in the control group (mean difference 8.757) compared to the Shot-Blocker group.

Conclusions: The Shot-Blocker technique was efficient to reduce pain-related intravenous-cannulation. Most children using Shot-Blocker experienced less pain compared to those who did not. This suggests that innovative non-pharmacological approaches like Shot-Blocker are advantageous for pain reduction.

© 2023 College of Nursing. Published by University of Baghdad.

*Corresponding author: Wasit Governorate Health Directorate, Ministry of Health, Iraq. E-mail: salsabeel.alaa2204m@conursing.uobaghdad.edu.iq. (Naser S. A.). ORCID: https://orcid.org/0009-0009-0940-3790, **DOI:** https://doi.org/10.58897/jwvdwd13
2023 College of Nursing. Published by University of Baghdad

فعالية مانع الحقن في تخفيف الألم المصاحب لإدخال القسطرة الوريدية الطرفية لدى الأطفال في سن المدرسة الذين تم إدخالهم إلى المستشفى

المستخلص

الاهداف: تقييم تأثير أداة مثبط الالم (الشوتبلوكر) في تقليل الألم المرتبط بالقنية الوريدية الطرفية بين الأطفال المرضى في عمر المدرسة.

المنهجية : هذه الدراسة استخدمت تصميم التجربة العشوائية مستقبلية المقارنة المعشاة. الدراسة شملت ١٥٣ من شريحة أطفال في عمر المدرسة (٦-١٢ سنة) حيث تلقوا ادخال قنية وريدية في قسم الطوارئ في واسط، مستشفى العزيزية والنعمانية العام ضمن الفترة الزمنية ٢٢ كانون الثاني، الى ٢١ شباط, ٢٠٢٤ . تم تقسيم المرضى عشوائيا الى مجموعتين: مجموعة الشوتبلوكر (عدد =٧٩)، ومجموعة ضابطة (عدد=٧٤). بعد إجراء ادخال القنية الوريدية الطرفية طلب من المرضى تقييم مستوى الألم لديهم باستخدام مقياس وونغ بيكر للألم. تم استخدام المقاييس الإحصائية الوصفية والاستدلالية في تحليل البيانات من خلال استخدام برنامج **IBM-SPSS**. تم قياس الفروقات بين المجموعات في مستويات الألم باستخدام اختبار **t** للعينات المستقلة.

النتائج: هناك فروقات ذات دلالة إحصائية معنوية في شدة الألم بين مجموعة الشوتبلوكر ومجموعة ضابطة-**P value=0.001*).** استشعرت مجموعة الشوتبلوكر انخفاضا ملحوظًا في شدة الألم مقارنة بمجموعة ضابطة (متوسط الفرق=١,٧٤٦٨٤). بالإضافة إلى ذلك، لوحظت درجات ألم أعلى في مجموعة ضابطة (متوسط الفرق= ٨,٧٥٧) مقارنة بمجموعة الشوتبلوكر .

الاستنتاجات: تقنية مثبط الالم (الشوتبلوكر) كانت فعالة في تقليل الألم المرتبطة بإدخال القنية الوريدية. اغلب الاطفال الذين ستخدموا الشوتبلوكر شعروا بألم اقل مقارنة بمن لم يستخدموه. هذا يشير الى ان الاساليب الغير دوائية المبتكرة مثل الشوتبلوكر مفيدة لتقليل الالم.

الكلمات المفتاحية: قسم الطوارئ؛ القنية الوريدية؛ الألم؛ الشوتبلوكر، الممرضين.

Introduction

The Emergency Department (ED) is an essential part of every hospital providing urgent medical interventions to patients who need immediate health care [1]. Research indicated that over 80% of children visiting ED receiving an intravenous cannulation providing by nurses [2].

Nurses work in collaboration with physician and other healthcare providers to ensure immediate and high-quality care to promote health outcomes and prevent death [3]. This multidisciplinary approach ensures that school-age children receive comprehensive care that supports their overall well-being and enhancing their ability to learn and thrive [4].

In Iraq, there is a lack of studies on the usage of peripheral intravenous cannulation in children. Although peripheral intravenous cannulation is widely used in hospitals worldwide, there is a noticeable absence of comprehensive global data on its evidenced-based pain management [5]. globally, approximately 1.2 billion peripheral intravenous cannulations are inserted in hospitalized patients annually [6].

According to the statement of the Iraqi Ministry of Planning, the percentage of the population under the age of 15 years reached 40.5% of the total population [7].

Guaranteeing comfort and reducing intravenous cannulation pain is important to the well-being of school-age children, by avoiding any difficulties that may occur in their future [8].

Neglecting to manage children with pain might increase the probability of developing an opioid addiction in adulthood. Children ages between 6 and 12 years is an important age-stage as their brain growth and developed. When children are exposed to unmanaged injection pain in a hospital, it can have effects on mental health development [9]. Children with unmanaged pain may develop hypersensitivity to pain, making them more likely to feel pain in the future from even minor stimuli. Unmanaged pain in childhood can leave lasting memory effects that continue into adulthood. Therefore, it is necessary to provide appropriate care for children to prevent these long-term effects [10].

Children who experience pain resulting from cannulation or injection procedures are particularly vulnerable to develop a fear of healthcare professionals, as they often describe

receiving a needle as one of the most uncomfortable and painful situations they have encountered [11]. Inadequate pain management during medical procedures in children can contribute to the development of needle phobia. This phobia usually appears between the ages of 5 and 10 years and is characterized by intense fear and anxiety. Most fears develop during childhood, and it is estimated that approximately one-quarter of adults have a fear of needles [12]. Therefore, it is necessary to reduce pain and provide a comfortable medical experience for children during painful procedures. Whereas many non-pharmacological techniques are available to reduce pain, it is crucial to select a method that is effective in reducing pain, cost-effective, easily accessible, and reusable. Thus, can better manage pain and prevent any negative consequences that may arise from unaddressed pain in the future [13].

Over the past few years, there has been an increasing concentrating on the study of pain in nursing research because managing patients' pain is a crucial part of patients care in healthcare settings [14]. Pharmacological interventions have the capacity to reduce pain, yet it is crucial to keep in mind that these interventions can lead to allergic responses, extra costs, and other adverse consequences, which may comprise the use of local anesthesia. Nonetheless, non-pharmacological techniques are effective in managing pain and may comprise various methods, such as music, video games, virtual reality technology, the use of distraction cards, Buzzy devices, like breathing exercises, skin stimulation, and massage [15].

It is crucial for nurses to recognize and utilize evidence-based, easily comprehensible non-pharmacological techniques to reduce pain [16].

The importance of this study lies in its ability to evaluate the effectiveness of non-pharmacological device in alleviating pain and improving comfort for school-age children undergoing peripheral intravenous cannulation. It is expected that the utilization of Shot-Blocker has the potential to relieve pain during short peripheral intravenous procedures, assuming that its application can effectively stimulate the skin, regardless of anatomical variations [17]. The Shot-Blocker is an easy-to-use plastic device that is designed with a simple C-shaped structure and small protrusions on its back. The Shot-Blocker, an innovative device designed to reduce injection discomfort, as it's made in the United States by Bionix® [18]. Additionally, this special tool is accessible to all ages. The majority of research has primarily focused on the application of Shot-Blocker in relation to intramuscular injections and vaccines, rather than focusing extensively on its use in intravenous cannulation [19,20]. Conducting the current study aiming basically to fill the gap in the previous researches and generate evidence-based recommendations for pediatric nurses practicing intravenous cannulation.

Methods

Study design

A randomized control trial design was utilized to examine the effectiveness of innovative strategies to evaluate the effectiveness of the Shot-Blocker device. Additionally, this design can be used to replicate the study elsewhere to provide confirmation and replication of the results for another age group, thus increasing confidence in the effectiveness of the Shot-Blocker device [21].

Sample and sampling

The focusing on largely homogeneous categories using a simple random sampling includes children aged (6-12 years). The elimination of bias is the primary advantage of the simple randomization employed in this study [22]. Following a comprehensive assessment by the emergency department physician, patients who filed a written approval for an intravenous cannulation were approached. The minimum sample size determination procedure is shown in Table (1). Figure (1) shows the consort diagram of the RCT Algorithm, the allocation sequence's randomization and sufficient concealment of such sequence when determined before subject's participation, are two essential characteristics for appropriate randomized trial, which were confirmed in this research trial.

Randomization

The tossing a coin method was chosen (heads-control, tails-Shot-Blocker). For instance, if the coin falls on heads participants are allocated to the control group, and if it falls on tails, they are allocated to the Shot-Blocker group. The sample consisted of (153) school age children's patients (6-12 years). These patients were allotted to the control group and Shot-Blocker group. This randomization method assists in ensuring that the allocation of participants is unbiased and that all

groups have a chance to be assigned in to the treatment. The response rate was approximately 92%.

Table 1. Determining the Minimum Sample Size

Criterion of calculating minimum sample size	specific Values
Effect size anticipated (Cohen's d)	5
Level of desired statistical power level	8
Level of Probability	05

The minimum size of the total sample (one-tailed hypothesis): 102
The minimum sample size for each group (one-tailed hypothesis): 51
The minimum total sample size (two-tailed hypothesis): 128
The minimum sample size for each group (two-tailed hypothesis): 64

Shot-Blocker Group

The Shot-Blocker is an easy-to-use plastic device that is designed with a simple C-shaped structure and small protrusions on its back. Its purpose is to divert attention and alleviate pain by exerting pressure on the skin during injection [23]. The Shot-Blocker effectively inundates the sensory nerves, redirecting the patient's focus away from the pain caused by the needle. Specifically, in this study, it was utilized on school-age children requiring intravenous cannulation to assess its efficacy in reducing pain. Developed by Bionix® in the United States, the Shot-Blocker is an original tool intended to minimize injection pain. However, all ages can utilize this unique tool.

The Primary Outcomes:

Description: the primary outcomes was to reduce pain related to intravenous cannulation for school age children.

Timepoint: The patient's response after giving the intravenous cannulation directly to measure the intensity of pain.

Method of measurement: Pain scale (Wong-Baker Faces) to measure the intensity of pain as a result of intravenous cannulation.

Data Collection Tool(s)

Socio-demographic and Clinical Data Form

The socio-demographic characteristics included (age, sex, residence, and level of education), and clinical data, which included (causes of emergency department admission, previous hospitalization experience, & previous venipuncture).

Wong–Baker FACES Pain Scale

This scale has been shown to be valid and reliable when used to evaluate pain among children whose age is ≥3 years. The Wong–Baker FACES Pain Scale (WBPS) was used in this study, as shown in figure (2). This Scale is considered the most widely approved and extensively used in young children [24]. It has been approved to use in this study by the author(s) of the scale. The Faces Pain Scale shows reliability and consistency when pain ratings are assigned by children, especially as they are associated with related pain experiences. It is a scale that can be reliably and validly used in young children, with minimal cognitive demands. Furthermore, when compared to the Visual Analogue Scale (VAS), the Wong-Baker Faces Pain Scale produced analogous and equivalent results [25].

The Intervention

The study was carried out in the emergency departments with school age children (6-12 years) patients who had a need for intravenous cannulation. They were randomly divided into two groups (n=153). The researcher introduced the patients to pain scale before the cannula insertion procedure, asking them to place a check in front of the face denoting the degree of the pain.

Interventional Procedure

After obtaining approval from the patient's caregiver or guardians, the initial step in conducting this research involved intravenous cannulation administration protocols to school age children's patients, as displayed in (Table 2). The same nurse used the standard insertion for cannulation, in terms of placing the Shot-Blocker in right or left hands. A 22 Gauge/ blue-color cannula was used for all insertions during the study. The Shot-Blocker was fixed with a plaster 2 cm above the area of the intervention. No more than 20 seconds should elapse in between the placement of Shot-Blocker and the cannula insertion. Following that, the pain level was determined using Wong-Baker Face Pain Scale.

Inclusion and Exclusion Criteria

The school age children patients admitted to the emergency department were chosen based on the following inclusion criteria: subject's guardians who consented to volunteer to participate in the research and being a school age of 6 - 12 years old. They had an intact hands skin when the intravenous cannula is inserted exclusively to the right or left hands. Also, those with no difficulty in communication, including hearing, vision, and speech, were chosen. Children who not obtaining oral or parenteral analgesic treatment before intravenous cannulation, and not being treated with chemotherapy medication.

Exclusion Criteria

Children with skin conditions such as burns, rashes, open wounds, abscess or boils, severe local infection or cellulitis at the intended IV cannula insertion site, were excluded. Peripheral vascular disease or compromised peripheral circulation at the intended IV cannula insertion site (e.g. peripheral neuropathy, diabetes, peripheral artery disease & Raynaud's disease), were also excluded. Blood clotting disorders or elevated danger of bleeding (e.g. hemophilia, thrombocytopenia), were also excluded. Anatomical abnormalities or restrictions that impede IV cannula proper insertion or outcome and increasing risk of complications, were also excluded. Children with history of repeated IV cannula insertion or IV injections within the last 3 months, were also excluded. Children with upper limb amputation were excluded, as well as those with a splint or cast on the right or left hands.

Setting

It was conducted in Wasit, Iraq, Al-Azizia and Al-Numaniyah General Hospital from January 22nd, 2024 to February 21st, 2024.

Ethical considerations

This interventional study research protocol was presented and consequently confirmed by the Committee of Scientific Research (CSR) at the College of Nursing, University of Baghdad, on November 22nd ,2023. The Ministry of Planning (Central Statistical Organization) official agreement was obtained on December 12th, 2023. The study protocol was prospectively documented in the database of the Iranian Registry of Clinical Trials in January 21st, 2024. The registration reference is IRCT20230714058776N1 and the trial ID was 74139. The researchers explained the study's aims, duration, and technique to reassure the participants. Next, the oral and written consents was granted from the patient's caregivers. The patient's parents or legal guardians signed the written consent forms. Of equal importance, parents or legal guardians were informed that participation in the study is completely voluntary and would have no financial or legal consequences, and that their patient's information will be kept privately. To ensure the full protection of the rights, welfare, and well-being of human participants during their participation in a study, the researchers have successfully passed the Human Research Protection Fundamental Training provided by the Office for Human Research Protections (OHRP).

Data analyses

Descriptive and inferential statistical measures were employed in the analysis of the data through the using IBM-SPSS. The demographic data and levels of pain for Shot-Blocker, and control groups were described using descriptive statistics. The group's differences in levels of pain were measured using an independent sample t-test. To calculate the variation in pain scores between each of the previously described groups.

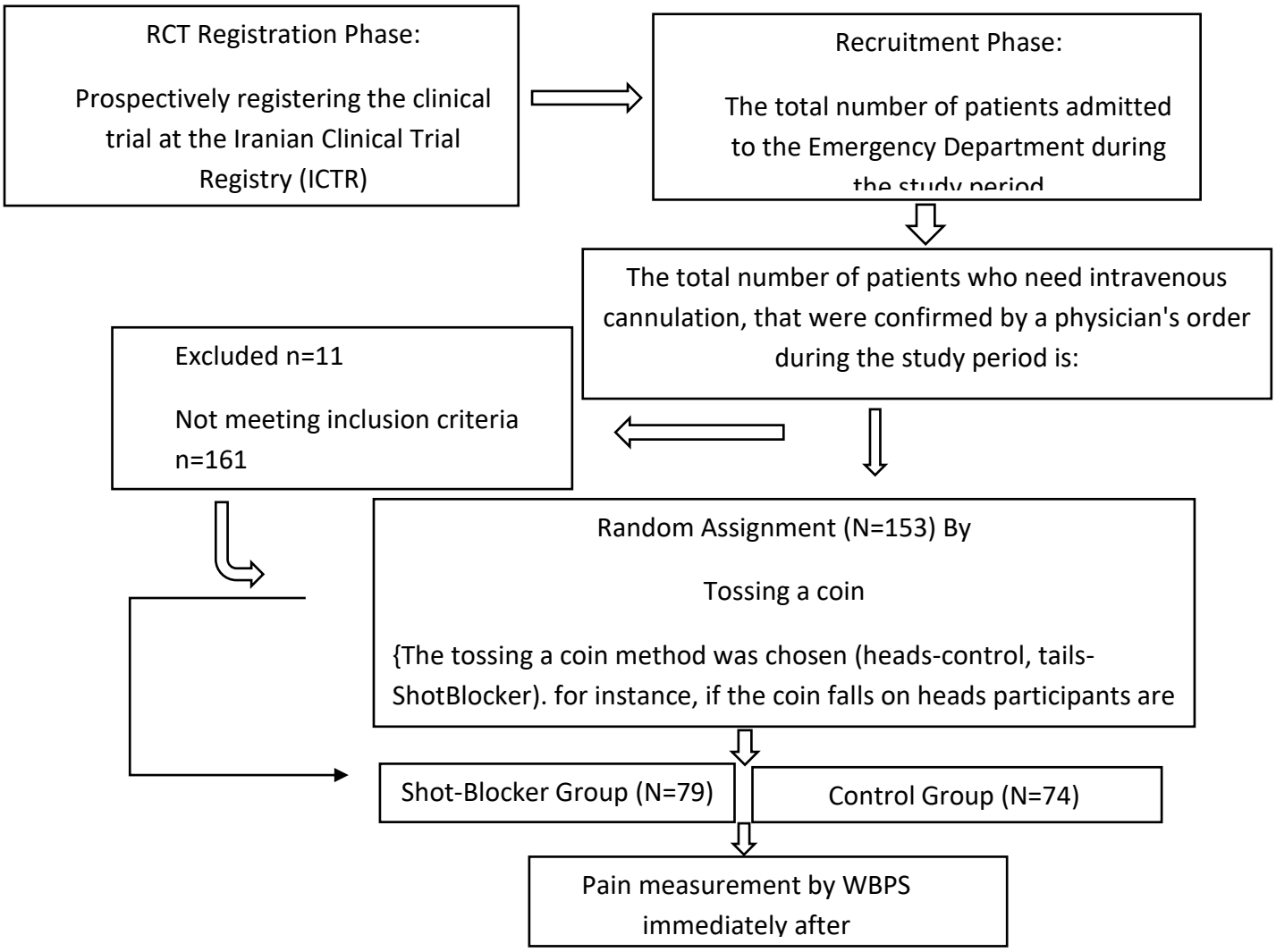

Figure 1: Study Protocol Algorithm

Figure (2): Wong–Baker FACES Pain Scale

Table 2. Intravenous Cannula Insertion Protocol

Hand washing is applied
Gloves are worn.
The appropriate vein is selected for IV cannula insertion
The tourniquet is attached 10-12 cm above the selected vein. The selected hand is below heart level.
After felt the vein by palpation, cleaning the area with 70% alcohol and waiting for 5 seconds to dry, was done.
The needle is held at an angle of 30-45 degrees to the skin approximately one centimeter below the intended vein

point of entry. Then, advanced into the vein by reducing the angle to about 15 degrees as soon as the needle enters the hole.
Blood fills into the cannula as soon as the needle enters the vein. Then, inserting the needle into the vein slowly, was done.
The needle is retracted one centimeter with the inactive hand once released the hand under the arm. The needle is in the lumen of the vein if blood is flowing. Then, the plastic part is inserted into the vein slowly.
Using the inactive hand, the tourniquet opens without causing the angio catheter inside the vessel to move
It is checked to determine whether the area is any painful, swollen or red
Finally, cannula fixed on skin with tape.

Results

Table 3. Sociodemographic characteristics of children in both groups.

Variable	Frequency	Percent
Age control group (Years): Mean (SD): 8.76 ± 2.06		
6-8	35	47.3%
9-10	20	27.0%
11-12	19	22.7%
	74	100.0%
Age Shot-Blocker (Years): Mean (SD): 8.98 ± 2.02		
6-8	34	43.1%
9-10	22	27.8%
11-12	23	29.1%
	79	100.0%
Residency control group		
Urban	56	75.7%
Rural	18	24.3%
	74	100.0%
Residency ShotBlocker		
Urban	50	63.3%
Rural	29	36.7%
	79	100.0%
Sex control group		
Male	44	59.5%
Female	30	40.5%
Sex Shot-Blocker group		
Male	46	62.2%
Female	33	37.8%
Education control group	65	87.8%
Elementary School	9	12.2%
Middle School	74	100.0%
Education Shot-Blocker group		
Elementary School	68	86.1%
Middle School	11	13.9%
	79	100.0%

Table (3) reveals that the mean age for participants in the control group was 8.76 ± 2.06; less than a half age 6-8-years (n = 35; 47.3%), followed by those who age 9-10-years (n = 20; 27.0%), and those who age 11-12-years (n = 19; 22.7%). Also, the mean age for participants in the Shot-Blocker group is 8.98 ± 2.02; more than two-fifth age 6-8-years (n = 34; 43.1%), followed by those who age 9-10-years (n = 22; 27.8%), and those who age 11-12-years (n = 23; 29.1%). Concerning residency, most children live in urban areas for control and Shot-Blocker groups (n = 56; 75.7%, 50; 63.3%), respectively. More than half in the control group were males (n = 44; 59.5%) compared Shot-Blocker group (n = 46; 58.2%). The majority of children in the control group were primary school students (n = 65; 87.8%) compared to those in the middle school (n = 9; 12.2%). Also, the majority of children in the Shot-Blocker group were in the primary school (n = 68; 86.1%) compared to those in the middle school (n = 11; 13.9%).

Table 4. School children' medical history

Variable	Frequency	Percent
Previous admission control group		
Yes	18	24.3%
No	56	75.7%
	74	100.0%
Previous admission Shot-Blocker group		
Yes	11	13.9%
No	68	86.1%
	79	100.0%
Previous venipuncture control group		
Yes	74	100.0%
No	0	0.0%
Previous venipuncture Shot-Blocker group		
Yes	74	100.0%
No	0	0.0%

Table (4) results exhibit that most children in the control and Shot-Blocker groups do not have previous hospital admission (n = 56; 75.7% vs n = 18; 86.1%). All children in the two groups never have previous venipuncture.

Table 5. Differences in pain intensity among control and Shot-Blocker groups

One-Sample Test						
	Test Value = 0					
	T	df	P value	Mean Difference	95% Confidence Interval of the Difference	
Pain					Lower	Upper
Control group	61.471	73	0.001*	8.757	8.47	9.04
Shot-Blocker group	15.840	78	0.001*	1.74684	1.5273	1.9664

Df= degree of freedom; **F**= F-statistics; **Sig**.: *P-value <0.01

The study results indicates that there are statistically significant differences in pain intensity between control and Shot-Blocker groups (p-value = 0.001).

Discussion

School aged children represent a significant demographic for research endeavors that seek to assess the impact of pain management methods. School-age children can better communicate how they feel pain and the impact of the technology used on it, making it easier to collect data and evaluate the effectiveness of the used devices. Reducing pain can be of great importance for improving the quality of life of this age group [26].

Statistical analysis of this study indicates that an observed significant difference shown in pain intensity between Shot-Blocker and control groups.

In terms of research, there are few studies applying Shot-Blocker to reduce pain resulting from intravenous cannulation among school age children, this studies results come with different outcomes and methods [27]. However, several randomized controlled experimental studies have explored application of non-pharmacological procedures in this context. Many studies were conducted to examine the effectiveness of Shot-Blocker with various injection techniques for all ages [28-30].

Zengin & Yayan [31], carried out a randomized controlled trial study to evaluate the impact non-pharmacological interventions including Shot-Blocker and Palm Stimulator on reducing pain level during intramuscular injection during ampicillin or sulbactam administration to children aged (7-10) years in pediatric emergency department. The Shot-Blocker and Palm Stimulator both were efficient in reducing pain level in children when compared to the control group. The results of Zengin & Yayan study support the results of current study on the effectiveness of using Shot-Blocker in reducing pain during injection procedures. These tools likely work by providing a form of sensory distraction, which can help to reduce the perception of pain during the injection. This study adds scientific evidence to nursing practices in the scientific literature.

Karabey and Karagözoğlu [32], conducted a study on intravenous cannulation using pre-post design in adults to evaluate effectiveness of Shot-Blocker on relieving pain. Based on the study's findings, using of Shot-Blocker during intravenous cannulation is a useful technique to pain reduction. This study proves that the Shot-Blocker tool is effective in reducing pain in children and adults.

Sivri and Balci [33], highlighted those 3 techniques: Shot-Blocker, Buzzy device, and distraction card were effective in reducing pain and anxiety in children. This study is consistent with the results of our study on the effectiveness of Shot-Blocker. This study contributes to enhancing confidence in using Shot-Blocker as an effective tool not only to relieve pain but also to reduce anxiety associated with needle-related procedures in children.

The pain reduction that occurs when using Shot-Blocker may work through mechanisms called gate control theory [34]. According to this theory, it has been demonstrated that regulations of pain occur especially in the spinal cord, within the central nervous system. This process is known as neuronal gating [35]. The pain signals are sent from the brain to the nerves within nerve gate control [36]. According to this theory, pain can be relieved by focusing on non-painful nerve signals that affect the closure of the nerve gate and reduce pain. Because of these mechanisms, when the needle permeates the skin, it produces low pain [37].

Finally, application of alternatives interventions appropriately in specific situations is one of health care providers' most important responsibilities. They should depend on evidence-based practice in making pain reduction decisions. Many healthcare providers realize the importance of their crucial role in alleviating pain for patients [38].

This depends on providing emotional and cognitive support to patients, guiding them about appropriate non-pharmacological methods to relieve pain. These integrated efforts contribute to enhancing patients' quality of life and improving their experience in dealing with pain and illness [39].

Socio-demographic and medical

In terms sex, there is a higher percentage of males compared to females in two groups. The majority of participants in the control group were males. Similarly, in the Shot-Blocker group, the majority of participants were males. This suggests that male might show a stronger inclination towards physical activities or adventurous, potentially raising the likelihood of getting injured. Male may exhibit more daring behavior in social situations, heightening their risk of sustaining injuries. Topcu et al [40], the findings of these study align with our study in terms of sex. Revealing a higher presence of male participants compared to females among school age children.

The control group and Shot-Blocker group included the majority of primary school participants, while relatively few participants from middle school (first grade). This suggest that participants' ages range from 6 to 12 years old, the majority naturally fall within the primary school age range. According to UNICEF (2023), the official 12-year educational pathway in Iraq begins of 6 years primary education, 3 years of median level education and then 3 years of secondary-level education. There is no study found to investigate the application of Shot-Blocker on children of primary school.

In terms of participants' medical history in table (4), the study findings indicate that the majority of participants in the Shot-Blocker group and control group had not been previously admitted to the hospital. Additionally, none of the children in any of the three groups had undergone venipuncture previously during the last 3 months. This suggest that the participants being relatively healthy prior to the study or limited exposure to medical procedures in three months prior.

Limitations

There were a few difficulties conducting the study because it is new and the first of its sort in Iraq. Examples of such predicaments are but not limited to: importing the Shot-Blocker electronically because this tool is unavailable in Iraq. This research was conducted in to Hospitals, which may limit the result's generalizability to a wider range subjects. The emergency wards are designed for emergency cases, making it not feasible to conduct randomized control trials (RCT). Also, the presence of morning consultation clinics makes obtaining a sample during the morning shift problematic and difficult. Of equal importance, the study's small sample size may limit the result's generalizability to a wider range subjects. Finally, there may be other factors that could influence the pain experienced during peripheral intravenous cannulation, such as anxiety levels and previous experiences.

Implications

School nurses should educate school-age children and their parents about the benefits and proper use of Shot-Blocker to alleviate pain associated with injection process. The Shot-Blocker could be highly beneficial for patients who are more sensitive to pain or have a history of experiencing discomfort during intravenous cannulation. By using this device, nurses can potentially mitigate the pain associated with intravenous cannulation for these patients, leading to increased satisfaction with their care. Establishing a pain management protocol that incorporates Shot-Blocker, as a non-pharmacological technique in nursing practices for reducing pain in school-age children, enhance the provided nursing care quality. Using evidence-based practices, healthcare

professionals can create educational programs and workshops for nurses on how to use non-pharmacological techniques during intravenous cannulation.

Conclusion

The Shot-Blocker application effectively reduce the intravenous-cannulation related pain levels. Most of Children having Shot-Blocker experienced less pain when receiving injections compared to those who did not use the Shot-Blocker. This suggests that utilizing techniques to reduce pain levels during intravenous cannulation is advantageous, particularly innovative non-pharmacological approaches like the Shot-Blocker device.

Acknowledgments

The authors extend thanks to the Collage of Nursing at the University of Baghdad and to the patients and their families for their cooperation for facilitating research procedures.

Conflict of interest

The authors declare that they have no conflict of interest.

Funding

None.

Data availability

The data supporting the findings of this study are not publicly available due to ethical and privacy considerations but may be made available from the corresponding author upon reasonable request and with appropriate approval.

Author contribution

Sadeq AL-Fayyadh, contributed to the original drafting, editing, supervision, and critical review of the manuscript. Salsabeel A. Naser undertook data collection, analysis, and manuscript structuring. Salsabeel A. Naser was involved in drafting and revising the manuscript. All authors reviewed and approved the final manuscript for publication.

References

1. Pavedahl V, Holmström IK, Meranius MS, von Thiele Schwarz U, Muntlin Å. Fundamentals of care in the emergency room–An ethnographic observational study. International emergency nursing. 2021 Sep 1; 58:101050. https://doi.org/10.1016/j.ienj.2021.101050
2. Huang LS, Huang Y, Hu J. Current practices of peripheral intravenous catheter fixation in pediatric patients and factors influencing pediatric nurses' knowledge, attitude and practice concerning peripheral intravenous catheter fixation: a cross-sectional study. BMC nursing. 2021 Dec;20:1-9. https://link.springer.com/article/10.1186/s12912-021-00758-1
3. Alkhatib GS, Al Qadire M, Alshraideh JA. Pain management knowledge and attitudes of healthcare professionals in primary medical centers. Pain Management Nursing. 2020 Jun 1;21(3):265-70. https://doi.org/10.1016/j.pmn.2019.08.008
4. Hassanein SM, Tantawi HR, Sadek BN, Hendy A, Awad HA. Impact of structured simulation-based and on-job training program on nurses' competency in pediatric peripheral intravenous cannulation: Children's hospital experience. Nurse Education Today. 2021 Mar 1;98:104776. https://doi.org/10.1016/j.nedt.2021.104776
5. Shaker NZ. Monitoring Peripheral Intravenous Catheters Complications in Pediatric Patients in Erbil City/Iraq. Erbil Journal of Nursing and Midwifery. 2022 Nov 30;5(2):105-13. https://doi.org/10.15218/ejnm.2022.12
6. Van Loon FH, Puijn LA, van Aarle WH, Dierick-van Daele AT, Bouwman AR. Pain upon inserting a peripheral intravenous catheter: Size does not matter.

The journal of vascular access. 2018 May;19(3):258-65. https://doi.org/10.1177/1129729817747531

7. Jadoo SA, Alhusseiny AH, Yaseen SM, Al-Samarrai MA, Mahmood AS. Evaluation of health system in Iraq from people's point of view: a comparative study of two different eras. Journal of Ideas in Health. 2021 May 20;4(2):380-8. https://doi.org/10.47108/jidhealth.Vol4.Iss2.100
8. Swartzentruber M. The importance of providing multimodal analgesia: A literature review of nonpharmacologic pain treatments. https://digitalcommons.liberty.edu/honors/1092/
9. Costello SE, Geiser E, Schneider N. Nutrients for executive function development and related brain connectivity in school-aged children. Nutrition Reviews. 2021 Dec 1;79(12):1293-306. https://doi.org/10.1093/nutrit/nuaa134
10. Pavlova M, Orr SL, Noel M. Parent–Child Reminiscing about Past Pain as a Preparatory Technique in the Context of Children's Pain: A Narrative Review and Call for Future Research. Children. 2020 Sep 7;7(9):130. https://doi.org/10.3390/children7090130
11. Czech O, Wrzeciono A, Rutkowska A, Guzik A, Kiper P, Rutkowski S. Virtual reality interventions for needle-related procedural pain, fear and anxiety—a systematic review and meta-analysis. Journal of Clinical Medicine. 2021 Jul 23;10(15):3248. https://doi.org/10.3390/jcm10153248
12. Ali S. Untreated Children's Pain Matters. Journal of the Dow University of Health Sciences (JDUHS). 2023;17(2):49-51. https://doi.org/10.36570/jduhs.2022.2.1660
13. Tavakolian A, Ebrahimimn M, Ahmadi SR, Foroughian M, Habibzadeh SR. The effect of pharmacological and non-pharmacological methods on reducing the severity of pain when injected in children: A systematic review study. medical journal of mashhad university of medical sciences. 2020 Oct 22;63(4):2526-38. https://doi.org/10.22038/mjms.2020.17171
14. [23] Liz Stokes JD. ANA Position Statement: The ethical responsibility to manage pain and the suffering it causes. Online Journal of Issues in Nursing. 2019;24(1):1-6. DOI:10.3912/OJIN.Vol24No01PoSCol01
15. Wu Y, Zhao Y, Wu L, Zhang P, Yu G. Non-pharmacological management for vaccine-related pain in children in the healthcare setting: A scoping review. Journal of Pain Research. 2022 Jan 1:2773-82. https://www.tandfonline.com/doi/full/10.2147/JPR.S371797
16. Heshmatifar N, Salari M, Rad M, Saleh TA, Borzoee F, Rastaghi S. A New Approach on the pain management of intramuscular injection: A Triple-Blind Randomized Clinical Trial. Pain Management Nursing. 2022 Jun 1;23(3):353-8. https://doi.org/10.1016/j.pmn.2021.01.010
17. Karabey T, Karagözoğlu Ş. The effect of new device on pain and comfort levels in individuals undergoing peripheral intravenous cannula insertion. The Journal of Vascular Access. 2024 Mar;25(2):432-8. https://doi.org/10.1177/11297298221113685
18. Rinker BD, Atashroo DA, Stout MA, Wermeling FR. The effectiveness of a non-invasive shot blocking device for reducing pain of in-office injections in hand surgery. Hand. 2021 Nov;16(6):770-5. https://doi.org/10.1177/1558944719884655

19. Mendes BV, Furlan MD, Sanches MB. Non-pharmacological interventions in painful needle procedures in children: integrative review. BrJP. 2022 Feb 16;5:61-7. https://doi.org/10.5935/2595-0118.20220004
20. Aydin E, Avşar G. Examining the effect of "Shotblocker" in relieving pain associated with intramuscular injection. Complementary therapies in medicine. 2019 Dec 1;47:102192. https://doi.org/10.1016/j.ctim.2019.09.001
21. Hariton E, Locascio JJ. Randomised controlled trials—the gold standard for effectiveness research. BJOG: an international journal of obstetrics and gynaecology. 2018 Dec;125(13):1716. https://doi.org/10.1111%2F1471-0528.15199
22. Lim CY, In J. Randomization in clinical studies. Korean journal of anesthesiology. 2019 Jun;72(3):221. https://doi.org/10.4097/kja.19049
23. Abdelkhalek WS. The effect of shot blocker and Z–Track techniques on reducing the needle pain and anxiety associated with intramuscular injection. International journal of Nursing Didactics. 2019 Dec 31;9(12):31-8. https://nursingdidactics.com/index.php/ijnd/article/view/2777
24. Kumari S, Jaya C, Reddy P, Reddy G. Pain intensity scales and studies comparing numerical rating scales and visual analogue scales. World J Pharm Res. 2022 Apr 14;11(7). https://wjpr.s3.ap-south-1.amazonaws.com/article_issue/dc859b30c7a8e919497d139a27d4b87f.pdf
25. Wong DL, Baker CM. Wong-Baker faces pain rating scale. Pain Management Nursing. 2012. https://psycnet.apa.org/doi/10.1037/t05330-000
26. Alam A. Educational robotics and computer programming in early childhood education: a conceptual framework for assessing elementary school students' computational thinking for designing powerful educational scenarios. In2022 International Conference on Smart Technologies and Systems for Next Generation Computing (ICSTSN) 2022 Mar 25 (pp. 1-7). IEEE. https://ieeexplore.ieee.org/abstract/document/9761354
27. Beneta V. Effectiveness of Squeezing Ball Technique on Reduction of Pain during Insertion of Intravenous Cannulation amongst Hospitalised Toddlers in a Selected Hospital, Kolar. Indian Journal of Continuing Nursing Education. 2023 Jul 1;24(2):162-7. DOI: 10.4103/ijcn.ijcn_13_23
28. Xess PA, Sarna R, Sethi S, Chauhan R, Meena SC, Saini V, Luthra A, Singh N. Effect of CoolSense and EMLA cream on pain during intravenous cannulation in pediatric population: a randomized, controlled trial. Indian Journal of Pediatrics. 2024 Feb;91(2):119-24. DOI: 10.1007/s12098-022-04233-w
29. Tok Aydın Ş, Güven ŞD. The effect of shot blocker application on intramuscular injection pain in adults: A randomized controlled trial. http://hdl.handle.net/20.500.11787/2616
30. Gautam S, Mall P, Prakash R, Yadav K, Raman R, Singh MK. Efficacy of ShotBlocker device versus vapocoolant spray for spinal needle pain relief during spinal anaesthesia in elective caesarean section-A randomised controlled trial. Indian Journal of Anaesthesia. 2024 Apr 1;68(4):329-33. DOI: 10.4103/ija.ija_845_23
31. Zengin M, Yayan EH. A comparison of two different tactile stimulus methods on reducing pain of children during intramuscular injection: a randomized controlled study. Journal of Emergency Nursing. 2022 Mar 1;48(2):167-80. https://doi.org/10.1016/j.jen.2021.10.006
32. Karabey T, Karagözoğlu Ş. The effect of new device on pain and comfort levels in individuals undergoing peripheral intravenous cannula insertion. The Journal of Vascular Access. 2024 Mar;25(2):432-8.

https://doi.org/10.1177/11297298221113685

33. Sivri BB, Balci S, Dolgun G. The Effect of 3 Methods (Buzzy, ShotBlocker, and DistrACTION Cards) Used While Taking Blood Samples From Children with Pain and Anxiety: A Randomized Controlled Trial. Pediatric Emergency Care. 2023 Aug 1;39(8):600-7. DOI:10.1097/PEC.0000000000002866
34. Bilge S, Aydin A, Gun C, Aldinc H, Acar YA, Yaylaci S, Cinar O, Balci V. Comparison of the efficacy of ShotBlocker and cold spray in reducing intramuscular injection-related pain in adults: A prospective, randomized, controlled trial. Saudi medical journal. 2019 Oct;40(10):996. https://doi.org/10.15537%2Fsmj.2019.10.24322
35. Uma B, Clement I. Gate Control Theory of Pain. IDC Int J. 2020;7(3):54-7.DOI: http://doi.org/10.47211/idcij.2020.v07i03.014
36. Hao H, Ramli R, Wang C, Liu C, Shah S, Mullen P, Lall V, Jones F, Shao J, Zhang H, Jaffe DB. Dorsal root ganglia control nociceptive input to the central nervous system. PLoS Biology. 2023 Jan 5;21(1):e3001958. https://doi.org/10.1371/journal.pbio.3001958
37. Heitler B. Primary Afferent Depolarization and the Gate Control Theory of Pain: A Tutorial Simulation. Journal of Undergraduate Neuroscience Education. 2023;22(1):A58. https://doi.org/10.59390%2FPWFC1224
38. Palomaa AK, Huhtala S, Tuomikoski AM, Pölkki T. Effectiveness of technology-based interventions compared with other non-pharmacological interventions for relieving procedural pain in hospitalized neonates: a systematic review. JBI Evidence Synthesis. 2023 Aug 1;21(8):1549-81. DOI: 10.11124/JBIES-22-00179
39. Hafez DM, Ali WG. ShotBlocker versus cryotherapy for reducing pain and anxiety associated with subcutaneous injection. Frontiers of Nursing. 2023 Sep 1;10(3):363-71. https://doi.org/10.2478/fon-2023-0039
40. Topcu SY, Kostak MA, Semerci R, Guray O. Effect of gum chewing on pain and anxiety in Turkish children during intravenous cannulation: a randomized controlled study. Journal of pediatric nursing. 2020 May 1; 52: e26-32. https://doi.org/10.1016/j.pedn.2019.12.00