ARTICLE

PHARMACOLOGICAL AND NON-PHARMACOLOGICAL METHODS OF PAIN RELIEF IN VENIPUNCTURE AND HELP TO MAINTAIN THE ARTERY FLOW IN CHILDREN, WITH TOOLS SUCH AS SMART IV

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ABSTRACT

Introduction: *In response to pain, children get irritable, restless and excited. Most children predict the pain caused by injection and prevent it by non-conformist behavior associated with anxiety before the injection. It usually takes them a lot of time to accept the injection. Hence, the present study tackles with examining ways to reduce pain in venipuncture and help to maintain and intravenous line in children.* ***Materials and methods:*** *Studies selected for this article had the design of a descriptive article, case-control, cohort and clinical trial. The keywords in articles published during 2003 to 2016 were searched and articles in English and Farsi were selected and studied.* ***Results:*** *The results of different studies show that implementation of various distraction programs lead to reducing pain and anxiety caused by a painful and stressful procedures in different age groups. Also, using tools that increase the durability of intravenous route, such as Smart IV, can help to alleviate pain and anxiety for children by reducing the number of venipuncture.* ***Conclusion:*** *Given that prevention is an essential part of nursing care, providing health and disease prevention are the objectives that should be considered by nurses. Health professionals should strive to accompany painful procedures with interventions so that the patient suffers from the minimum and in order to minimize the adverse effects of the disease.*

KEY WORDS
Children, pain, venipuncture

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INTRODUCTION

Pain is derived from the Greek word “Peon” meaning suffering and punishment. [1]. According to the International Society of Pain [IASP or International association for the study of pain], pain is an unpleasant feeling derived from a sensory or emotional experience associated with actual or strong damage. American pain society defined pain as the fifth vital sign in 2000 and called the decade 2010-2001 [2] as the decade of pain control [3]. This association stresses the initial forecast of pain and preventing pain and pain relief in case of incidence and states that adequate treatment of pain needs checking its severity and the individual's response to the prescribed treatment. [4]. Due to illness and hospital admission, children are subjected to many painful and uncomfortable cares. Venipuncture is among painful procedures that is part of the child's everyday experiences. Many children consider venipuncture a painful and terrifying act, because this procedure is an invasion to the spiritual, mental and physical medium of child for the child and involves some threats for the child. [5]. Observational studies of pain average prevalence among preschool and elementary school in daily care units for each child has been reported to be between 41% - 34% per hour. In response to pain, children get irritable, restless and excited and they may even have nightmares, sleep disturbance and malnutrition and those who have not relieved from the pain may feel victimized, depression, isolation and loneliness. Their parents often feel distrust and anger toward health systems and feel depressed and guilty for failing to prevent pain and that nothing they can do. Therefore, children who require frequent invasive medical treatments experience long-term helplessness and distress. [4] In a study by Turk. And Melzak, more than 64% of children aged 3 to 6 years reported IV venipuncture and blood sampling to be very painful and annoying, because young children are extremely sensitive to your body and show more sensitivity to venipuncture procedures since, compared to other procedures, the plastic venous catheters remains in body. If no appropriate soothing measures are applied at the time of performing painful procedures, this will ensure that children consider all nursing activities and actions painful and associated with pain perception and has this fear adulthood. Such physical and mental tensions in childhood will be the basis of lifestyle in other periods of life [3]

MATERIALS AND METHODS

Studies selected for this article had the design of a descriptive article, case-control, cohort and clinical trial. The keywords in articles published during 2003 to 2016 were searched and English articles with keywords like children, pain, distraction cards, Venipuncture Touch on Intensity, and Persian keywords such as pain, distraction, touch, children, anxiety, venipuncture, etc., were entered in the study.

RESULTS

In 2001, some standards for evaluation and pain management were proposed by JCAHO. The statement acknowledged that pain should be regularly reviewed and response to its treatment should be controlled and except in cases where pain is necessary for a treatment, in other cases, pain should be minimized or eliminated. Pain management includes using all the ways to prevent, reduce or relieve the pain. [6]. That is

why the measures done in the field of relieving children's pain during and after venipuncture can be divided into two general ways:

Pharmacological and non-pharmacological strategies

In pharmacological management of pain, a variety of local anesthetics like Emla cream or other medical practices such as sucrose and oral melatonin etc. are applied and in non-pharmacological approaches, methods of distraction, relaxation with the help of music, cold therapy, touching, watching animations etc. all of which leads to decreased pain and greater tolerance of the child can be used.

Pharmacological strategies

In their study, Kazemi and his colleagues evaluated the effect of EMLA cream on pain of venipuncture in 12- to 6-year-old children in hospitals of Rafsanjan. 80 children were randomly examined in two groups of control and intervention [n = 40 per group]. In the intervention group, EMLA cream was applied 60-45 minutes before venipuncture in position and was dressing while the usual venipuncture was performed for the control group. The results showed that pain intensity during venipuncture in the two groups showed a statistically significant difference to the extent that the average pain intensity in the intervention group is greater than in the control group. [7]. The results of the study done by Khalili Shumia and his colleagues with the aim of assessing the impact of anesthetic EMLA ointment on the severity of the pain caused by venipuncture with IV revealed that the pain of venipuncture using EMLA ointment significantly lessens compared to the pain of venipuncture with Vaseline ointment. Short-term side effects and discoloration in the area of application were observed in 20% of subjects [8]. Chyarty and colleagues [2011] carried out a study with the aim of the efficacy of a calming protocol on the basis of nasal lidocaine spray and midazolam [INM] on 46 children ages 5 to 50 months. 1 puff of spray [10 mg] was applied prior to venipuncture. The results showed that using a combination of lidocaine spray and midazolam [INM] seems to be a safe and effective method to achieve short-term sedation in children in order to facilitate the care and medical procedures. [11]. In their study with the aim of assessing the effect of oral melatonin as a sleep-anesthesia agent in reducing pain and anxiety in 60 children aged between 1 to 14 years old during venipuncture in Italy, C. Kuo Pari et al. [2015] concluded that the use of 0.5 mg oral melatonin per kilogram of body weight [up to 5 mg], 30 minutes before blood sampling could have a significant impact in reducing pain and anxiety in children. [12]. The results of the study conducted by Wilson and colleagues [2013] with the aim of using oral sucrose to reduce neonatal pain during venipuncture in infants aged 6-1 months showed that 25% ml2 sucrose has a significant effect in pain relief in infants. [13].

Non-Pharmacological strategies

Non-pharmacological strategies are widely used in pain management and coping with emotional distress [14] that can be divided into two categories: cognitive interventions [behavior therapy] and interventions and means influencing mechanisms of pain. The most important non-pharmacological intervention for pain relief is behavior therapy method among which one can mention distraction. In this method, the subject's attention is diverted from painful stimuli and his attention is attracted to pleasant stimuli which in general reduce the perception of pain. Apart from having fewer side effects compared to pharmacological methods, this method is also less expensive. Besides, this method is devoid of toxic and destructive psychological effects on the child. This method is comfortable to use, requires little training and more importantly, is of independent nursing interventions and it is very attractive for young children. [3]. In a study, Allawi and his colleagues examined the effect of bubble blowing on pain of venipuncture performed in children with thalassemia. In this method that is a combination of regular breathing and visual distraction by watching the bubbles, the child's concentration is drawn up on making bubbles. On the other hand, this method reduces muscle stiffness through relaxation, slacken pleura relax and the child feel freedom and lightness with each deep breathing. The results showed that the bubbling method reduces the pain of venipuncture. With respect to the fact that the bubble blowing method is more economical, using different techniques of distraction by nurses during venipuncture will promote life quality of children with thalassemia. [15]. The results of the study conducted by Vosoughi and colleagues showed that distraction through the bubble blowing reduces the physiological responses and the pain of venipuncture in children aged 6-3 years old. [3]. Dalla Kvist et al. [2002] carried out a study with the aim of determining the effects of distraction on the pain of injection procedures performed on six children aged 8-2S years old. The results of this study showed that different methods of distraction reduce pain in children successfully. [16]. Gupta and colleagues [2014] conducted a study to explore the impact of animation on the amount of pain during venipuncture on 70 children under 7 years old in Punjab, India. Children were divided into two 35-member groups. In group A, only family members accompanied the child during venipuncture while in group B, in addition to family members' accompaniment, animations and video clips were used. Then FLACC scale was used to measure pain intensity. The results showed that pain severity in group A was 3.86 and 2.43 in group B. Group A experienced the maximum amount of pain [88.57%] and they did not calm during venipuncture. While the second group showed less pain [28.58%] of which about 25% of them were comfortable and only 20% of them showed severe pain. [17].

Means and interventions effective in mechanisms of pain

Abazari and his colleagues conducted a study with the aim of determining the effect of Hugo point massage with ice on the pain of venipuncture in 86 12- to 80-year-old children with thalassemia. In the intervention group, 5 minutes before venipuncture, Hugo point was massaged with ice while the control group received no intervention. The results this study showed that pain intensity was significantly lower in the intervention group than in the control group. [27] Schreiber et al. [2016] in a study evaluated a dithering cooling device called BUZZY in reducing pain in children with mental disorders in Italy. 70 children aged about 9 years old were randomly divided into two groups. In a 34-member group the BUZZY was used during venipuncture and the 36-member group received no intervention. The results showed that this device during venipuncture leads to the reduction of pain in children with mental [cognitive] disorders. Also, because of its special design, this device causes the child's distraction. [28]. There is a cooling spray that, unlike other anesthetic methods, is not chemical-based. As soon as the spray is applied in the area, gestures of pain impulses in the sensory nerves of the skin are reduced and its effect is manifested in less than one hour.

Studies evaluating the effects of different methods comparatively are as follows

The results of the study carried out by Allawi and his colleagues to evaluate distraction and EMLA cream showed that there was a significant difference between the average numeric and photographic pain intensity of distraction and EMLA cream methods with normal procedures, but there is no significant difference between distraction and EMLA cream methods. So both methods lead to reduction of the pain of venipuncture. However, given the fact that distraction method is more economical than the cream EMLA, using this method is recommended. [29]. The results of the study conducted by Nick Fried and his colleagues evaluate the use of ice and EMLA cream showed that there was no significant difference between the two groups of ice and EMLA cream. Then, because the use of non-pharmacological methods in pain relief is preferable over pharmaceutical procedures in terms of cost and availability, it can be said that in case of lack of access to pharmacological methods to relieve pain associated with venipuncture procedures, non-pharmacological method of using ice can be applied. [32]. Akdas and his colleagues [2014] in a study to compare the Valsalva Manor [VM] with EMLA cream in reducing pain during venipuncture in children concluded that the Valsalva Manor as a practical and simple method could lead to reduction of children's pain, but its effectiveness is not as much as that of EMLA cream. [33]. In Japan, Kytazava and his colleagues [2015] used the combination of EMLA cream [2.5 percent lidocaine and prilocaine 2.5%] and distraction methods, preparation and training. Of the 132 children participants, 58.3% did not cry during venipuncture procedure and 71.9% felt that this method eliminates fear in children. 90.9% were satisfied with the procedure and 75.8% thought that this method should be applied during venipuncture in children. [34].

Table 1: Pharmacological strategies

The average pain intensity in the intervention group was lower than in the control group. (7)	Intervention group: EMLA cream was applied 60-45 minutes before venipuncture in position and was dressing Control group: The usual venipuncture was performed.	Kazemi et al	2014	The average pain intensity in the intervention group was lower than in the control group. (7)	EMLA cream (EMLA)
The pain of venipuncture using the EMLA ointment is significantly less than the pain of venipuncture with Vaseline ointment. (8)		Khalili Shumia et al.	2012	The pain of venipuncture using the EMLA ointment is significantly less than the pain of venipuncture with Vaseline ointment. (8)	
The pain of venipuncture using Diclofenac Gel is significantly less than the pain of venipuncture with Vaseline ointment. (9)		Khalili Shumia et al.	2012	The pain of venipuncture using Diclofenac Gel is significantly less than the pain of venipuncture with Vaseline ointment. (9)	Diclofenac Gel
The minimum recommended treatment time is 60 minutes, but by increasing the amount of time (over 90 minutes) less pain was felt.(10)		William T .	2008	The minimum recommended treatment time is 60 minutes, but by increasing the amount of time (over 90 minutes) less	EMLA) Lidocaine -%2.5 Prilocaine 2.5%(

				pain was felt.(10)	
The time it takes for the effect of anesthesia EMLA cream to appear is about 60 minutes or greater while the duration for the effect of anesthetic tetracaine gel to manifest is about 45-30 minutes. The durability of the effect of tetracaine gel after the application is 4 to 6 hours more than EMLA cream. (10)		Smith & Nephew		The time it takes for the effect of anesthesia EMLA cream to appear is about 60 minutes or greater while the duration for the effect of anesthetic tetracaine gel to manifest is about 45-30 minutes. The durability of the effect of tetracaine gel after the application is 4 to 6 hours more than EMLA cream. (10)	Tetracaine gel *
EMLAEMLAApplying it for 30 minutes has the same effect as using EMLA cream for 60 minutes and its effect is about 25% the same as that of EMLA cream. But this method has not been studied in children under two years. (10)				EMLAEMLAApplying it for 30 minutes has the same effect as using EMLA cream for 60 minutes and its effect is about 25% the same as that of EMLA cream. But this method has not been studied in children under two years. (10)	لیپوزومال لیدوکائین 4%*
Children in topical adhesive group of lidocaine and tetracaine had less pain compared to the placebo group, and 59% of children did not feel any pain. (10)		Chadds Ford		Children in topical adhesive group of lidocaine and tetracaine had less pain compared to the placebo group, and 59% of children did not feel any pain. (10)(	Topical adhesive containing a thin layer of Lidocaine and tetracaine layer 70 mg / 70 mg *
Using a combination of lidocaine spray and midazolam (INM) appears to be safe and effective method to achieve short-term sedation in children in order to facilitate the care and medical procedures. (11)		Chiaretti A	2011	Using a combination of lidocaine spray and midazolam (INM) appears to be safe and effective method to achieve short-term sedation in children in order to facilitate the care and medical procedures. (11)	Intranasal lidocaine and midazolam spray (INM)
Using 0.5 mg of oral melatonin per kilogram of body weight (up to 5 mg), 30 minutes prior to blood sampling can have a significant impact in reducing pain and anxiety in children. (12)		Marseglia L	2015	Using 0.5 mg of oral melatonin per kilogram of body weight (up to 5 mg), 30 minutes prior to blood sampling can have a significant impact in reducing pain and anxiety in children. (12)	Oral melatonin
2 mL of 25% sucrose has a significant effect in pain relief in infants. (13)		Wilson S	2013	2 mL of 25% sucrose has a significant effect in pain relief in	Oral sucrose

				infants. (13)	

Table 2: Non-Pharmacological strategies

Bubble method reduces the pain of venipuncture. And with respect to the fact that the bubble blowing method is more economical, using different techniques of distraction by nurses during venipuncture will promote life quality of children with thalassemia. (15)		Allawi et al.	2008	bubbling
Distraction through the bubble reduces the physiological responses and severity of the pain of venipuncture in children 6-3 years old. (3)		Chehrzad et al.	2010	
Various methods of distraction have successfully reduced pain in children. (16)		Dahlquist LM	2002	Distraction
Group A experienced the maximum amount of pain (88.57%) and they did not calm during venipuncture. While the second group showed less pain (28.58%) of which about 25% of them were comfortable and only 20% of them showed severe pain.(17)	Group A: Only family members accompanied the child during venipuncture.Group B: In addition to family members' accompaniment, animations and video clips were used.	Gupta HV	2014	Animation
Watching TV significantly reduces pain during venipuncture in children (18)		C V Bellieni	2006	watching TV
The pain in the intervention group using distraction techniques was less than in the control group. (19)		Windich-Biermeier A	2007	Distraction (bubble, books, music, three-dimensional glass and manual video games)
Distraction significantly reduces pain and distressful behavior in the intervention group compared to the control group. (20)		Vessey JA	1994	Distraction
Using toys as a distraction during venipuncture is effective in reducing mild to moderate pain. (21)		Rhonda Winskill	2008	Distraction (toy)
In the experimental group 3/63% of children had mild pain and no child reported severe pain and in the control group 0/50% of children had mild pain and 3/33% of children had severe pain. (22)(		Shamshiri et al	2012	Pressing small and soft balls
The most effective way to relieve pain and anxiety in children during the bloodletting was distraction cards. (23)		Canbulat N	2014	Two methods of cards with distraction and kaleidoscope
Using the kaleidoscope has reduced pain in children. (24)		Karakaya A	2012	kaleidoscope
	EG group: (In the presence of dogs) CG group: (In the absence of dogs)(25)	Vagnoli L	2015	The use of animals (dogs)
Music has a beneficial effect in reducing anxiety before, during and after blood tests, and pain in the intervention group was lower than in the control group. (26)		Caprilli S	2007	Songs and music

Table 3: Interventions and tools effective in the mechanisms of pain

Pain intensity was significantly lower in the intervention group than the control group. (27)	Intervention group: 5 minutes before venipuncture Hugo point was massaged with ice.Control group: No intervention was conducted.	Abazari et al.	2014	Hugo point massage with ice
Using this device during venipuncture will lead to a reduction in pain in children with mental disorders. Also, due to its special design, this device results in child's distraction. (28)	Intervention group: BUZZY was used during venipuncture Intervention group:No intervention was conducted.	Schreiber S	2016	Dithering cooling device (BUZZY)
Upon using this spray in the area, starting and gestures of pain impulses in the sensory nerves of the skin is reducedand the onset of action in less than a minute and is very fleeting. (10)				Cooling Spray

Table 4: Comparing different methods

There is a significant difference with normal procedure, but there is no significant difference between the methods of distraction and EMLA cream. So both methods reduce the pain of venipuncture. However, considering the distraction method is more economical than the cream EMLA, using this method is recommended. (29)		Allawi et al.	2005	Distraction and EMLA cream
Application of anesthetic cream had more impact on the pain of venipuncture in children. So that, it can be recommended that the cream is applied in the desired location routinely one hour before venipuncture and music is used as a useful method for distraction of children. (30)		Pourmovahed et al.	2008	Music and anesthesia EMLA cream
Pain intensity of venipuncture using music method and EMLA cream is significantly less than the child's pain using the normal method. Also, no significant difference was observed between the severity of pain during venipuncture using distraction (music) and EMLA cream. (31)		Shahabi et al.	2007	
There is no significant relationship between EMLA and ice groups. Then, because the use of non-pharmacological methods is preferable over pharmaceutical procedures in pain relief in terms of cost and availability, it can be said that in case of lack of access to pharmacological methods to relieve the pain of venipuncture procedures, non-pharmacological method of using ice can be applied. (32)		Nick Fried et al.	2010	Ice and EMLA cream
Valsalva Mano, as a practical and simple method, can effectively reduce pain in children, but it is not as effective as EMLA cream. (33)		Akdas O	2014	Valsalva Mano (VM) and EMLA cream
Aggression and cries reduces with clownish acts and the pain is alleviated with EMLA cream. So, it is better to reduce pain with EMLA cream and however distraction through slapstick is helpful. (35)		Meiri N	2015	Clownish acts and EMLA cream
		Biran V	2011	EMLA cream and oral sucrose(36)
There is a significant difference between the pain in the normal method with touching and bubble. However, a significant difference was found between the average pain intensity in bubble	The first group before and during venipuncture were	Razzaghi et al.	2012	Distraction and touch

technique and touching technique. So both methods of bubble play and touch are effective in reducing the pain of venipuncture in children. (37)	encouraged to bubble-making play. The second group received touching the injection area at the same time. The control group received no intervention.			
Venipuncture pain was moderate in the usual method. But in the method of using music and rhythmic breathing technique Hey-Ho, pain was mild. Moreover, comparison of the pain of venipuncture in these three methods showed that both pain of venipuncture was lower in music and rhythmic breathing technique Hey-Ho than in the usual method and that the music method had the least pain. (38)	In the first visit, venipuncture in the usual method, it means without distraction, was performed. In the second visit, music was used to create a distraction and on the third visit, Hey -Hv rhythmic breathing technique was used to create a distraction.	Vali Zadeh et al.	2004	Music and Rhythmic Breathing Technique
The pain of venipuncture is reduced by means of distraction methods, relaxation, rhythmic breathing and music among which music is more effective in reducing pain. (39)		Ismaili et al.	2008	Rhythmic Breathing and music
All used methods reduced significantly pain and anxiety in children during blood-taking. (40)		Sahiner NC	2015	Three methods of distraction (cards for distraction, listening to children's programs music and inflating balloons)
During venipuncture, the smell of vanilla and breast milk, both have calming influence on the infant. But after venipuncture, just the smell of breast milk has a calming effect. So breast milk, compared with the scent of vanilla, has more calming effect on preterm infants. (41)		Jebreili M	2015	The smell of breast milk and vanilla smell

DISCUSSION AND CONCLUSION

The results of research conducted in the field of distraction shows implementation of distraction procedure has reduces pain and anxiety of treatment procedures in children suffering from various diseases. Therefore, with a variety of methods of distraction, we can reduce the effects of destructive experience of painful and stressful procedures in children who suffer from a lot of pain during painful procedures of diagnosis, treatment and control of their disease. Given that one of the main roles of nurses is to get access to non-invasive methods for the treatment and care of patients, it is hoped that the results of these studies expand the field of nursing activities associated with pain and anxiety of children before medical procedures and increase the quality of nursing care. Nurses play an important role in the control of pain and anxiety in patients, especially children. Nurses who care for their patients' pain and anxiety, try to reduce them and establish a better relationship with their patients. In fact, by reducing pain and anxiety, nurses can increase children's satisfaction. With respect to the satisfactory results in reducing pain and anxiety in children, it can be introduced as a convenient method for relieving pain and anxiety in children that is easy-implemented and low-cost. Training non-pharmacological methods such as distraction to other social groups, such as parents and teachers is also useful. By engaging children to do these procedures at the time of facing with painful cases, they can reduce adverse physical and psychological effects in children

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