

The Effect of Distraction Techniques on the Pain of Venipuncture in Children: A Systematic Review

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Abstract

Context: Venipuncture has been reported as one of the major sources of pain in the children's wards. Various distraction techniques have been used so far to reduce this pain. Distraction technique is one of the non-pharmacological methods of pain control that uses the five senses in order to focus the patient's attention on other stimuli.

Objectives: This study aimed to determine the effect of distraction techniques on the pain of venipuncture in children.

Data Sources: In this systematic review study, all RCTs about distraction techniques were reviewed with no time limit. In order to find evidence in this context, English and Persian scientific databases (PubMed, Elsevier, SID, e.g.) were searched by specified keywords like venipuncture, distraction, and pain.

Study Selection: All studies assessing the effect of distraction techniques on the pain of venipuncture in children were examined in our systematic review. A number of 148 articles were found in the initial investigation of titles, abstracts, and main-texts. After the elimination of duplicates and irrelevant ones, eventually 31 RCT studies and 2 review articles entered the study.

Data Extraction: A checklist was used to extract required data from relevant articles on name, year and type of study, sample size, age range of participants, type of intervention, employed method, and obtained results.

Results: Based on the findings, various techniques of distraction were used on pain control in children including music, virtual reality, audio-visual equipment such as cartoons, animation and video game, squeezing rubber balls, Filippits distraction cards, Hugo point ice massage, making bubbles, breathing exercise, Kaleidoscope color screen and touching the palm of the hand to reduce the pain of venipuncture.

Conclusions: Distraction techniques can reduce the pain of venipuncture in children. It is suggested to make these techniques more effective and apply them by considering the age and mental and physical conditions of children.

Keywords: Review, Pain, Venipuncture, Pediatrics, Non-Drug Techniques

1. Context

Pain is a subjective experience with cognitive, behavioral, and emotional dimensions which is affected by environmental, socio-cultural, and evolutionary factors of an individual (1). Due to the great importance of pain, pain association of America (PAA) has announced it as the fifth vital sign and also called 2001 - 2010 as the pain control decade (2). The pain resulted from medical procedures is one of the stressful and scary experiences in children (3-5). Despite medical advances in the assessment and management of pain in the past years, according to the studies, most children admitted to hospitals in Finland and Canada, have reported moderate to severe pain levels (6, 7).

Among the common therapeutic procedures, venipuncture has been reported as one of the largest sources of pain in the children's wards (8) that in case of

failure to use appropriate strategies to relieve the pain, the risk of adverse physical outcomes including impairment of cardio - vascular and immune system (1, 2, 6), psychological "depression" (9), delayed recovery and prolonged hospital stay (10) will increase. Also, pain can disrupt the communication between nurses and children due to stress and anxiety and hence inhibit treatment procedures and care (2, 11, 12). Therefore, managing the pain resulted from procedures associated with needle therapy is one of the therapeutic priorities (9).

With an emphasis on the adverse effects of pain on the treatment procedures of children, two strategies have been proposed to reduce pain in children, including pharmacological and non-pharmacological therapies (10). Several non-pharmacological interventions for pain control have been discussed as case study and their superiority in terms of fewer side effects and costs over pharmacologi-

cal interventions has been proven (11, 13, 14). Distraction as a non-pharmacological technique due to less costs and side effects and more accessibility has been more attractive in children (15-18). Distraction is one of the pain control techniques utilizing five senses in order to focus the patient's attention on other stimuli and hence control pain in a better way (3, 19). Some of the various methods of distraction used to reduce pain in children include handheld video games (15), audio-visual systems (watching cartoons) (11), Bubble maker tools and mobile toys (2, 20), listening to music (21), and therapeutic touch (22). However, the effect of distraction has been denied in the study of Landolt et al. In the latter study, it was stated that distraction technique using playing video games had no effect on the pain reduction in children hospitalized with burns (23). Meanwhile, other studies have investigated "The effect of distraction on pain, fear and distress during venous access port and venipuncture in children and adolescents with cancer" (19) and "The effect of active distraction on the pain of children during venipuncture" (24). Although distraction reduced pain, no significant difference was observed between the two groups in one study (19). Therefore, more comprehensive studies seem useful to discover the exact effect and benefits of this technique in pediatric pain and provide a clearer picture in this regard. By an overview of the available databases, two related review articles were found; one of them dealt with the effect of distraction techniques and hypnosis on the pain of procedures associated with needle. In that review article, the studies from 1987 to 2012 were investigated (3). The other review article dealt with the control of pain associated with painful procedures such as dental measures only among school-age children. They also examined limited databases (8).

2. Objective

The present review study provides specific evidence to assess the impact of distraction techniques on the pain of venipuncture in children. We hope the results of this study are helpful in managing pain and stress resulted from painful medical procedures and thereby improve the quality of health care provided to patients in therapeutic settings. This systematic review study aimed to determine the effects of distraction techniques on controlling pain of venipuncture in children during three months from July to September 2016.

3. Data Sources

To do literature review, the components of a systematic review of population intervention comparison outcome (PICO) were considered as a part of the search process

(25, 26) and articles were searched and classified accordingly. Then, national databases "SID, Magiran, IranMedex and Irandoc" and international databases "Google-Scholar, Medline, PubMed, Elsevier, ProQuest, Springer and Web of Science" were searched by using the Mesh keywords including "venipuncture, catheter insertion, IV line, venous port access, distraction, pain, Children and pediatric" with no time limit since the foundation of these databases until 2016. These keywords were determined and searched by two experts through the databases. On the other hand, to increase sensitivity and specificity, the search was done using OR/AND functions. Then, resources and databases were reviewed and searched by one of the researchers to ensure the adequacy of gathered data. Moreover, gray literature was entered the study. Presented articles at international and national congresses by searching in the Civilica database were examined; also, published theses were searched in the IRANDOC database. Moreover, review articles were investigated based on the criteria of PRISMA checklist. Also, all the references of articles were searched.

4. Study Selection

Inclusion criteria of articles included: 1) using a randomized control trial (RCT) method, 2) focusing on the control of venipuncture pain in children, and 3) papers published in Persian or English language journals. Also after reviewing studies which had conditions such as: 1) ambiguity in the expression of methods and results such as the possibility of bias, 2) poor quality of paper, 3) lack of access to Persian or English full-text, and also 4) studies conducted on infants (children below 1 year) were excluded from the study.

5. Data Extraction

A checklist was designed and used to extract data from articles including: name, year and type of study, sample size, age range of participants, type of intervention, applied method, and obtained results. Out of 148 articles found by investigating titles, abstracts, and main-texts, after the elimination of duplicates and irrelevant ones, eventually 31 RCT studies and 2 review articles entered the study. The Figure 1 shows the stages of selection of the studied articles.

6. Results

The obtained studies had been conducted from 2003 to 2016 with the aim of determining the effects of various

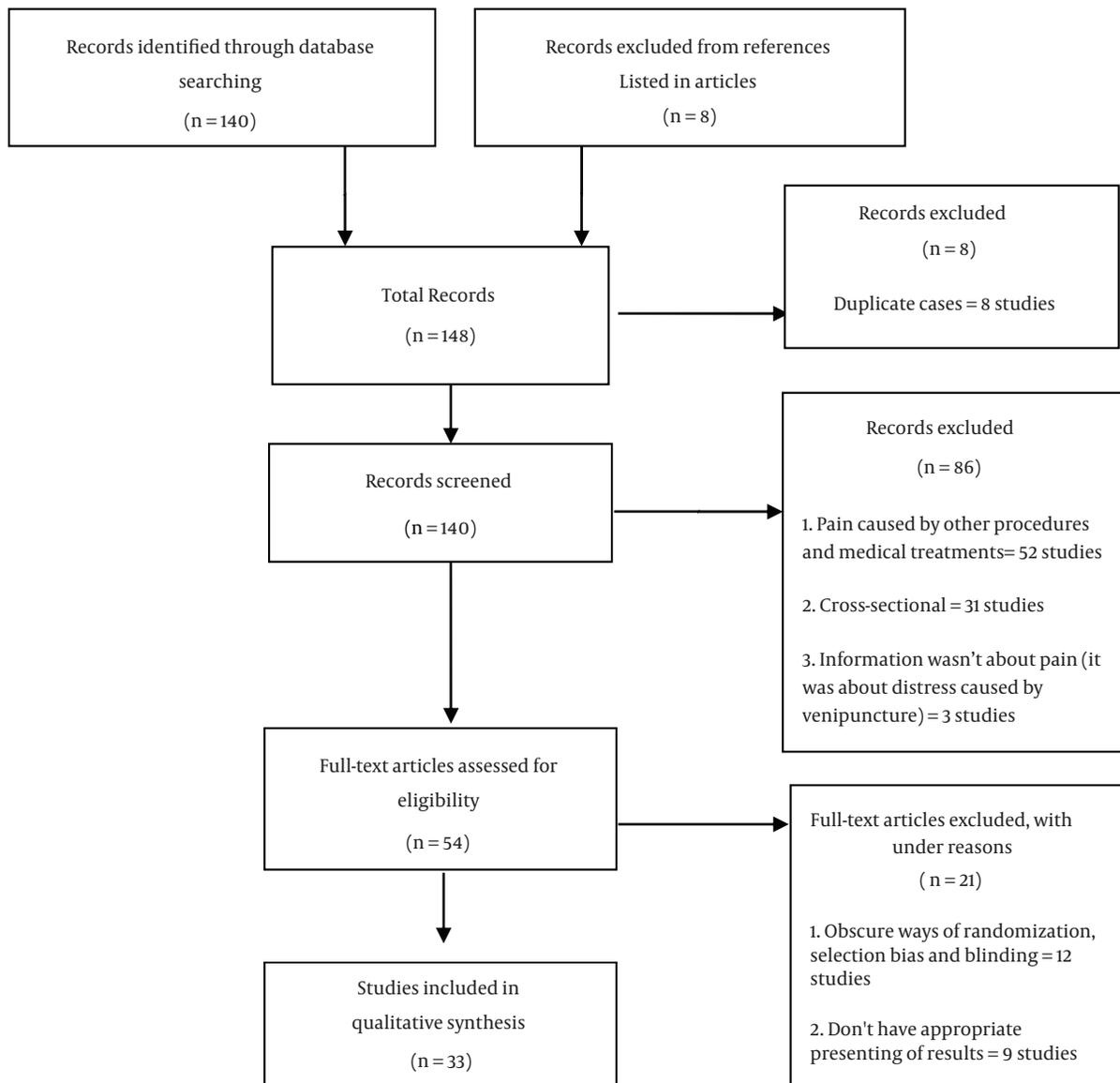


Figure 1. Flowchart of Articles Selection Process

distraction techniques on the pain of venipuncture in children. Age of children in most studies ranged from 5 to 15 years. Also, minimum and maximum sample sizes were 22 and 100, respectively. Distraction in children took place by music (4 studies), virtual reality (1 study), audio-visual systems such as cartoons, animation, and video games (12 studies), squeezing the plastic ball (3 studies), Filippits cards (1 study), Hoku points ice massage (1 study), making bubbles (5 studies), doing breathing exercise (1 study), Kaleidoscope Color screen (2 studies), and touching with the palms (1 study). Pain, stress, and fear of children were

measured by frequently-used tools such as visual analogue scale (VAS), Oucher pain scale, and Wong-Baker FACES scale. In all the reviewed articles, based on the issues expressed in [Table 1](#), the effect of most of the various distraction interventions on the pain severity of children undergoing the venipuncture procedure was significant and positive. However, pain severity variations in each study were different. In some studies, the effect of distraction techniques by listening to music (24), watching cartoons (27), playing video games (28, 29) and using kaleidoscope (30) was not reported significant. Other findings are provided in detail

in Table 1.

7. Discussion

Distraction is one of the non-pharmacological techniques of pain management strategies. In this method, all five senses of the patient are engaged to focus his/her attention on other stimuli; this results in better control of pain (3, 19). So far numerous studies have been conducted to assess the efficacy of distraction techniques in pain of venipuncture procedures in children using music (24, 31-33), virtual reality (34), audio-visual systems such as cartoons, animation and video games (12, 27, 29, 35), pressing the plastic ball (36-38), Filippits distraction cards (39), Hoku points ice massage (40), making bubbles (9, 29, 41-43), doing breathing exercise (44), Kaleidoscope color screen (30, 45), and touching the palm of the hand (22). Listening to music is one of the distraction methods to reduce pain during venipuncture in children. The results have shown that performing live music for 4 to 12 years-old children during venipuncture (32), listening to Indian classical music by children of 5 to 12 years (31), and playing cheerful vocal music during venipuncture for 6 to 12 year-old children with thalassemia (33) can reduce the pain of venipuncture. It is possible that music by affecting person's level of awareness causes endorphins to secrete and leads to pain reduction in children (33). On the other hand, Press and et al by conducting a study on 6 to 16 year-old children showed that listening to music with headphones during venipuncture did not lead to a significant difference in pain scores between control and experimental groups (24). One of the probable reasons for the contradictory results of aforementioned studies is the difference in types of music. It seems that live performed music is more attractive than listening to music with headphones, so it can have more capability in distracting children. In addition, it is likely that the different results are originated from the fact that in the study conducted on children with thalassemia, the children referred to thalassemia center while in the study of Press and et al. the children referred to the emergency unit. Since several studies have reported high levels of anxiety in emergency departments, it can be stated that children admitted to an emergency department experience more anxiety and fear than children referring to thalassemia center and therefore they may feel more pain as well (46). Also, it is proposed that the difference between the results of Press et al. study and those of the study in which intervention was done using Indian classic music is related to differences in the type of music and cultural factors. It seems that these factors affect the perception of pain in children (47).

One of the distraction techniques to reduce children's pain during venipuncture is virtual reality. The result of a study in this regard has shown that this technique reduced the pain of venipuncture in 8 to 12 year-old children (34). It seems that this technique creates a virtual environment and allows people to interact with a simulated world through which, sight, sound, and motion stimulations are created in them (8).

Another distraction technique to reduce children's pain during venipuncture is watching television movies (35) and video cartoons (27) that have been discussed in many studies. The results of Bellieni and et al study on 7 to 12 year-old children showed that watching television was effective in controlling pain during venipuncture (35). In another study on 3 to 12 year-old children, it was stated that watching six minutes of a funny video cartoon during venipuncture was not effective in relieving pain (27). It seems that a possible reason for ineffectiveness of watching cartoons was lack of systematic guidance by trained nurses (27). On the other hand, it seems that the difference in the results of Bellieni and et al. study (35) with the aforementioned study is the presence of mother in the children's treatment room. This can increase pain tolerance and child support.

Based on a literature review, another distraction technique to reduce pain of venipuncture in children is watching animation. Results of some studies (12, 48) have shown that focusing children's attention on other stimuli can be an effective intervention to reduce the pain of venipuncture.

Playing video games is another distraction technique to reduce children's pain during venipuncture. The findings of a study carried out in Iran (15) following the intervention of video games on 3 to 6 year-old children showed that the mean of pain scores was significantly different in the intervention group than the control group (15). Although video games using visual sense of children seem effective in reducing the pain of this procedure, another study on 3 to 6 year-old children in Australia showed that there was no significant difference between two study groups (29). It seems that the difference in the results of the two mentioned studies can be related to the type of method applied to intervene with video games. In the study conducted in Iran, Sony video games made by SEGA Company were shown on a portable screen, while in the study carried out in Australia, video games were presented by an electronic tablet.

Another distraction technique to reduce children's pain during venipuncture is pressing a plastic ball. According to results of the studies, it can be stated that pressing plastic balls by children aged 4 - 12 can reduce the pain of venipuncture (36-38). Distraction methods such as squeez-

ing the ball can probably distract children and reduce their attention to pain through competing with sensory stimuli of pain. The results of the present review study indicated that one of the ways to reduce the pain of venipuncture in children is using distraction cards. According to the results of a study (39), it seems that the use of distraction cards by applying visual senses can distract children and consequently reduce the perception of pain in 6 to 12 year-old children.

Massage is another distraction technique to reduce children's pain during venipuncture. A study conducted on 6 to 12 year-old children reported that there was a significant difference in mean pain score between control and experimental groups (40). It seems that the effectiveness of ice massage in the reduction of pain follows the gate control theory of pain implying that transmission of nerve impulses created by cold to A-delta fibers can stop the pain (49).

Making bubbles is another distraction technique to reduce children's pain during venipuncture. The results of some studies (2, 42, 43) on the children between 3 and 12 years old showed that making bubbles by focusing attention on other stimuli can be effective in the relief of venipuncture pain. It is also worth noting that this method is not appropriate for patients at risk of infection, e.g. those hospitalized in burn wards and children with weak immune system such as children with cancer; thus, this distraction method is not applicable in all wards for all patients.

Another distraction technique to reduce children's pain during venipuncture is breathing exercise. According to the results of a study (44), it seems that aerobic exercise reduces the pain of venipuncture in 6 to 12 year-old children. Breathing techniques, if done right, can cause children to focus on their own breathing. Also, focusing on breathing during the procedure can cause brain cells responsible for recording provocations such as pain to get involved in these messages, and therefore fewer pain messages are recorded (50).

Using Kaleidoscope is also one of the distraction methods in reducing venipuncture pain in children. Kaleidoscope with the help of mirrors and reflected lights shows a variety of shapes and color schemes that are constantly changing. The results of a research on 7 to 12 year-old children showed the distraction caused by kaleidoscope significantly decreased the level of pain in the experimental group than the control group (51). Another study investigating the effect of distraction by parents and using methods such as kaleidoscope showed that although the intervention group had lower pain scores, no significant difference was observed between the experimental and control groups in terms of pain intensity (30). The difference in

the type of kaleidoscope used in the two studies can be a probable reason for differences in their results. This is because different types of this device can show different types of images with various designs and colors which can differently distract children's attention using their unique charm. Also, it is likely that the age differences in these two studies have led to different results. It seems that older children have more understanding of distraction stimulus and more pain tolerance (52).

To reduce the pain of venipuncture in children, distraction by using touching method is another technique. The findings of a study on 6 to 12 year-old children showed that following the intervention by the touching method, control and experimental groups had significant differences in the intensity of pain in the first and second needle insertions into the skin using a face pain assessment tool (FACES) (22). It seems that the effectiveness of the touching method in the pain reduction follows the gate control theory of pain, so that while feeling pain, the touching impulse closes the gate of pain control and causes fewer impulses transmission to the brain (53). Therefore, it can be concluded that touching for 5 minutes in the form of slow and rotating hits with palm and immediate hits during venipuncture can reduce the pain. However, there is a need for further studies in this regard.

7.1. Study Limitations

The search was conducted only in Persian and English language databases that can inhibit access to all the studies in this field. Therefore, more studies are suggested to be conducted on this important issue in future.

7.2. Conclusion

The results of reviewing Persian and English papers showed that various techniques of distraction can be applied in order to reduce the pain of venipuncture in children. According to the results of the mentioned studies, we found out that in order to reduce the pain of venipuncture in children more effectively, it is better to employ these techniques according to age as well as mental and physical conditions of children. Thus, all distraction methods are not applicable to all wards and patients. It should be noted that some of these methods such as making bubbles are not appropriate for patients at risk of infection due to burn wounds and children with weakened immune systems such as children with cancer. It seems that video games in the age range of 3 - 6 years, animation in 3 - 7 years, Making bubbles in 3 - 12 years, music and squeezing the plastic ball in 4 - 12 years, distraction cards, touching, Hugo point ice massage, and breathing exercise in 6 - 12 years, TV movies in 7 - 12 years, and virtual reality in the age range of

8-12 years can reduce the pain of venipuncture in children more effectively.

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Footnote

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Table 1. Summary of Data Extracted From the Reviewed Articles on Efficacy of Distraction Methods on Pain Relief in Children Undergoing Venipuncture

Author (Year)	Sample Size (n)	Type of Intervention	Variable/Instruments	Results	Conclusion
Press et al. (2003)	Ni = 48; nc = 46	Music via headphones and asked a question	Pain/Visual Analog Scale (VAS)	Intervention group: 2.8 ± 2; control group: 3.8 ± 2.9; between intervention and control groups: P > 0.05	There weren't significant differences between two groups.
Valizadeh et al. (2004)	N = 30	A. Distraction using music; B. Distraction using breathing techniques hey- ho	Pain/Oucher scale	Music group: 26.7% (no pain), 33.3% (mild pain), 40% (moderate pain), 0% (severe pain) and 0% (very severe); Hey-hu breathing group: 13.3% (no pain), 43.3% (mild pain), 30% (moderate pain), 13.3% (severe pain) and 0% (very severe); control group: 0% (no pain), 40% (mild pain), 46.6% (moderate pain), 6.7% (severe pain) and 6.7% (very severe); among three groups: P < 0.05	Music can reduce the pain associated with venipuncture.
Caprilli et al. (2007)	Ni = 54; nc = 54	Live musicians	Pain/Wong-Baker FACES pain rating scale (WBFPS)	Intervention group: 1.81 ± 0.89; Control group: 2.33 ± 1.19; Between two groups: P < 0.05	Live musicians can be effective in reducing pain after venipuncture.
Gold et al. (2006)	Ni = 10; nc = 10	VR (virtual reality) distraction using Street Luge (SDT), via a head-mounted display	Pain/Wong-Baker FACES pain rating scale (WBFPS)	Time 1: intervention group: 0 ± 0; time 2: intervention group: 2.00 ± 2.31; time 1: control group: 0.20 ± 0.63; time 2: control group: 2.00 ± 2.11; between two groups: P < 0.05	VR pain distraction can reduce pain in children undergoing acute medical interventions.
Belliemi et al. (2006)	Ni = 23; nc = 23; ni = 23	a) Cartoon TV distraction; b) Mother-directed distraction	Pain/Oucher scale	Mother distraction group: 17.39 ± 21.36; TV group: 8.91 ± 8.65; control group: 23.04 ± 24.57; between distraction group and control group: P < 0.05	TV watching can be effective in reducing level of pain during Venipuncture.
Balan et al. (2009)	Ni = 50; nc = 50; nL = 50	Music via headphones	Pain/visual analog scale (VAS)	Time 1; local anesyesia group: mean = 2; time 2; local anesyesia group: mean = 1; time 3; local anesyesia group: mean = 0; between three times (LA group): P = 0.03; time 2; music group: mean= 3; time 1; music group: mean=2; Time 3; Music group: mean =1; between three times (music group): P = 0.003; Time 1; control group: mean = 8; time 2; control group: mean = 6; time 3; control group: mean = 3; between three times (control group): P = 0.003	Indian classical instrumental music can reduce pain experienced during venipuncture.

Taket et al. (2006)	Ni = 20; n II = 21; n III = 20; n IV = 21; n V = 26; n VI = 28	A) Cartoon video, procedural information, and placebo cream; b) Procedural information and placebo cream	Pain/visual analog scale (VAS)	Group I (placebo, distraction, information): 2.58 ± 1.89; group II (EMLA, distraction, information): 1.62 ± 1.16; group III (placebo, information): 1.85 ± 1.18; group IV (EMLA, information): 1.50 ± 1.40; group V (information group): 2.82 ± 1.76; Group VI (Non-treatment control group): 2.30 ± 1.66; pain scores between the six groups: P < 0.05	EMLA reduces pain during Venipuncture but Procedural information and distraction showed no effects on pain due to Venipuncture.
Hana Yoo et al. (2011)	Ni = 20; nc = 20	Animation distraction intervention using a laptop computer	Pain/the 5-point poker chip scale (PCS)	Time 1: intervention group: 1.05 ± 1.05; time 2: intervention group: -0.55 ± 1.10; time 1: control group: 1.95 ± 1.43; time 2: control group: -1.35 ± 1.31; between two groups: P < 0.05	The use of an animation distraction intervention using a laptop computer can reduce pain during Venipuncture.
Minute et al. (2012)	Ni = 47; nc = 50	Active distraction: eMLA plus videogame	Pain/faces pain scale revised (FPS-r)	Intervention group: 1.36 ± 2.5; control group: 1.5 ± 2.5; between two groups: P > 0.05	Active distraction does not improve EMLA analgesia for venipuncture.
James et al. (2012)	Ni = 25; nc = 25	Animated Cartoons	Pain/faces, legs activity cry consolability (FLACC)	Time 1; intervention group: 2.26 ± 2.18; time 2; intervention group: 6.24 ± 2.09; time 3; intervention group: 2.94 ± 1.71; time 1; control group: 4.76 ± 2.08; Time 2; control group: 8.06 ± 1.70; Time 3; control group: 5.94 ± 1.61; between two groups (before, during, and after venipuncture): P < 0.05	Animated cartoon can be effective in managing behavioral responses due to pain during invasive procedures in children.
Vardhan et al. Gupta (2014)	Ni = 35; nc = 35	Animation distraction and video clipping	Pain/faces, legs activity cry consolability (FLACC)	Intervention group: 2.43 ± 1.092; control group: 3.86 ± 0.430; between two groups: P < 0.0001	Children who were held by a family member along with an animation during Venipuncture had less perception of pain.
Walsh Jane et al. (2014)	Ni = 22; nc = 22	interactive video games by using an electronic tablet)	Child pain/faces pain scale-revised (FPS-R)	Intervention group: 3.27 ± 3.57; control group: 3.36 ± 5.46; between two groups: P > 0.05	There were no significant differences between two groups.
Mahmoud El-Khedr Abd et al. (2015)	Ni = 50; nc = 50	A. interactive distraction (portable note video show); B. cutaneous stimulation (massage techniques)	Pain/visual analogue scale (VAS)	Interactive distraction group: 20%(no pain), 60%(mild pain), 20% (moderate pain), 0% (sever pain); Cutaneous stimulation group: 16%(no pain), 62%(mild pain), 18% (moderate pain), 4% (sever pain); Between two groups: P =.000	Interactive distraction technique was more effective than cutaneous stimulation in relieving pain during vein-puncture.
Kaheni et al. (2016)	Ni = 40; nc = 40	video game play	Pain/faces, legs activity cry consolability (FLACC)	Intervention group: 2.65 ± 1.577; control group: 7.95 ± 1.084; between two groups: P < 0.05	Video game play intervention can be effective in the pain of venipuncture procedures in children.

Crevatin et al. (2016)	Ni = 100; nc = 100	A. Angry Birds playing on a hand-held computer; B. By a trained nurse who sang to them, read a book, blew bubbles or played with puppets	Pain/Faces pain scale	Hand-held computer group: mean = 1.0; nurse-led low-tech distraction group: mean = 1.0; between two groups: P = 0.50	It seems that Playing a game on a hand-held computer can be effective in pain management during venipuncture.
Concepcion N et al. (2016)	Ni = 70; nc = 70	Video distraction	Pain/Wong-Baker faces pain rating scale (WBFPS)	Intervention group: 3.18 ± 1.72; control group: 5.74 ± 2.48; (CI 95%: 1.87 - 3.30; SEM: 0.31); between two groups: P < 0.001	Use of a video-distraction system can reduce pain in children during Venipuncture.
Gupta et al. (2006)	Ni (balloon) = 25; nc = 25; ni (distraction) = 25	A. Press a rubber ball (distraction); B. Inflate a balloon	Pain/visual analog scale (VAS)	Balloon group: 1+3; distraction group: 2 ± 2; control group: 4 ± 2; Between three groups: P < 0.05	Severity of pain reduced in the balloon group.
Sadeghi et al. (2013)	Ni = 30; nc = 30	Press a soft ball with the opposite hand during IVCI	Pain/Wong-Baker FACES pain rating scale (WBFPS)	Intervention group: 3.43 ± 1.77; control group: 5.26+3.46; between two groups: P = 0.012	Pressing a soft ball during IVCI can control or reduce pain in young children.
Sadeghi et al (2013)	Ni = 30; nc = 30	Pressing small and soft balls (as a distraction technique)	Pain/behavioral pain scale FLACC	Experimental group: 2.30 ± 2.11; control group: 3.80 ± 3.24; between the two groups: P < 0.05	Pressing a small ball can reduce behavioral pain reactions in children during Venipuncture.
Inal et al. (2012)	Ni = 61; nc = 62	"Filippits®" distraction cards	Pain/faces pain scale-revised (FPS-R)	Experimental group: 3.90 ± 1.94; (95% CI 3.91 - 4.39); control group: 6.51 ± 1.65; (95% CI 6.10 - 6.92); between two groups: P < 0.001	The method of distraction with the cards Filippits® was an effective strategy in reducing pain during blood sampling.
Abazari et al. (2015)	Ni = 43; nc = 43	Hoku point massage with ice	Pain/FLACC (faces, legs activity cry consolability)	Intervention group: 0.65 ± 0.75; control group: 2.56 ± 1.58; between two groups; P = 0.0001	Ice massage at Hoku point can relieve the venipuncture pain in children.
Alavi et al. (2005)	N = 32	A. Bubble making; B. EMLA cream	Pain/Numerical pain scale	Distraction group: 6.88 ± 10.30; EMLA cream group: 4.06 ± 7.56; control group: 17.81 ± 12.63; Between Distraction and EMLA cream group and control group: P < 0.05	Two methods of distraction, Using bubble making and EMLA cream can be effective in reducing the pain of venipuncture.
Vosoughi et al. (2011)	Ni = 36; nc = 36	Distraction using Bubble Maker device	Pain/Oucher tool	Intervention group: 36.1% (no pain), 22.3% (mild pain 41.6%, (moderate pain) and 0% (severe and very severe pain); Control group: 2.8% (no pain), 8.4% (mild pain) 30.5% (moderate pain) and 58.3% (severe and very severe pain) Between the two groups: P < 0.05	Distraction using bubble making device reduced the severity of pain associated with intravenous cannulation in children.
Razzaghi et al. (2012)	N = 40; n = 40; nc = 40	a. Bubble making; B. Touching the injection point	Pain severity/Wong and Baker face scale; (Wong and Baker)	Bubble making group: 5.77 ± 0.94; touch group: 5.95 ± 2.22; control group: 8.12 ± 1.53; between three groups: P < 0.001	Both methods of distraction, Bubble making and touching reduce the pain of intravenous cannulation in children.

Bagheriyan et al. (2011)	Ne = 20; nc = 20; ne = 20	A. Bubble making; B. Regular breathing exercise	Pain/numerical scale	Bubble-making group: 1.60 ± 1.75 ; breathing exercise group: 1.85 ± 1.42 ; control group: 5.60 ± 3.13 ; between the control group and other groups after the injection: $P = 0.000$	Regular breathing exercise and bubble making can be effective in reducing pain of catheter insertion in children.
Bagherian et al. (2013)	Ni = 20; nc = 20	a. Bubble making; B. Regular Breathing	Pain/pain's behavioral rating scale	Bubble making group: mean = 48.22; regular breathing group: mean = 53.18; between two groups: $P = 0.253$	Distraction methods of Regular Breathing and Bubble making can be effective in reducing the pain of injection procedures.
Bagheriyan et al. (2012)	Ni = 20; nc = 20	Regular breathing exercise	Pain/numerical pain scale	Intervention group: 1.85 ± 1.42 ; control group: 5.60 ± 3.13 ; between the two groups: $P = 0.0001$	Regular breathing exercise can be effective in reducing pain among children undergoing venipuncture.
Cavendar et al. (2004)	Ni = 20; nc = 23	A. Distraction with Kaleidoscope, Super Challenger book and Thomas the Tank Engine's Big Lift-and-Look Book	Pain/Wong-Baker FACES Pain Rating Scale (WBFPS)	Intervention group: 2.3 ± 1.87 ; control group: 2.74 ± 1.63 ; between the two groups: $P > 0.05$	Distraction with a kaleidoscope cannot reduce the children's pain experience during venipuncture.
Karakaya et al. (2015)	Ni = 72; nc = 72	Given a kaleidoscope	Pain/Faces pain scale-revised (FPS-r)	Intervention group: 1.80 ± 1.84 ; control group: 3.27 ± 2.87 ; between the two groups: $P < 0.05$	Distraction with a kaleidoscope can reduce the pain in children during venipuncture.
Safari et al. (2014)	Ni = 30; nc = 30	Touching in the form of palm motions and kicks	Pain severity/Faces Pain Scale rating (FACES)	Touch group: 7.8 ± 1.5 ; Control group: 9.0 ± 1.7 ; between the two groups: $P < 0.003$	Touching can reduce the pain of venipuncture.

Abbreviations: Nc, control group; ni, intervention group.