

Leg Crossing and Hand-gripping Interventions: It's Effect on Reducing of Vasovagal Symptoms Associated with Venipuncture in Pediatric Patients

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Abstract: Children are at high risk for vasovagal syncope or who had a past history of vasovagal symptoms due to venipuncture the leg crossing and hand gripping interventions appear to have an immediate beneficial effect on the decrease of these symptoms. The purpose of this study was to determine the efficacy of two simple interventions (a leg crossing and hand gripping) on reducing vasovagal symptoms associated with venipuncture in a group of pediatric patients. A quasi-experimental design was used. The study was conducted at emergency department in Menoufia University Hospital, at Shebeen El Kom City, Egypt. A purposive sample of 75 children was selected to carry out this study (25 in leg-crossing group, 25 in hand-gripping group and 25 in control group). Three instruments were used in this study. They were baseline data assessment record, vasovagal signs and symptoms checklist and children's satisfaction sheet. The results of this study showed that children in the leg-crossing group experienced fewer numbers (1.56) of vasovagal symptoms than their peers in the hand gripping group (4.56) and control group (6.21). The study concluded children who participated in the leg crossing and handgrip interventions would experience fewer numbers of vasovagal symptoms as compared patients who received standard care during venipuncture. So, it was recommended that leg crossing and handgrip interventions should be integrated as a part of routine daily care for children who had a past history of vasovagal symptoms.

Key words: Leg Crossing Technique, Hand-gripping, Vasovagal Symptoms, Venipuncture

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I. Introduction

Reflex syncope is a common medical problem in pediatric population. Vasovagal reflex syncope is the most frequent form common, carrying a significant health and psychological impact. It may occur at all ages, especially in children and adolescents. Some studies indicated that the incidence of syncope in the pediatric age that requires medical intervention is estimated at 125 of 100,000 subjects (0.125 %) Up to 15 % of the population experienced at least one episode of syncope before adulthood. Other studies estimated a higher rate that is up to 47 % of adolescent girls and 24 % of adolescent boys (Brignole et al., 2002 & Chu et al., 2015). A lower peak occurs in older infants and toddlers, most commonly referred to as "breath-holding spells." In the pediatric age, the most common etiology is certainly neutrally mediated syncope (61-80 %), followed by neurological-neuropsychiatric loss of consciousness (LOC) (11-19 %), and cardiac syncope (6-11.5 %). The etiology remains undetermined in 15-20 % of cases (Bronzetti et al., 2015).

Vasovagal syncope is a transient loss of consciousness triggered by emotional or orthostatic stress (fear, pain, standing quickly, and prolonged standing). It is usually preceded by prodromal symptoms of autonomic activation (sweating, pallor, nausea) (Alboni, 2012). Venipuncture is one of the most widely used diagnostic and therapeutic procedures in pediatric patients. It is a common procedure performed in hospitals. In some patients, venipuncture causes vasovagal symptoms including feelings of nausea, vomiting, dizziness, pallor, diaphoresis and fainting. Children with a history of vasovagal symptoms are at a higher risk of experiencing these symptoms during PIV placement or venipuncture (Yilmaz et al., 2013).

Current practice when pediatric patients report a history of vasovagal symptoms includes having patients lie down and instituting safety precautions in anticipation of possible syncope. While these interventions increase patient safety, they do not attempt to prevent the syncope symptoms from occurring (Crocini et al., 2004 & Han et al., 2006).

Many studies have observed interventions to decrease or prevent vasovagal symptoms in adult patients. Increased dietary salt intake and counter-pressure techniques were recommended as one of the first-line non-pharmacological treatment measures. Low cost and simple interventions, including hand gripping, leg

crossing, squatting maneuver arm tensing techniques are effective in aborting impending syncope in adult patients. Several studies have found that the stabilization of blood pressure occurs due to the effect of leg crossing and muscle tensing on venous return to the heart and thereby on cardiac filling, stroke volume and cardiac output (Wieling et al., 2011).

The study was conducted by McIntyre et al., (2018) about "Effectiveness of a Leg Crossing and Muscle Tensing Technique on Decreasing Vasovagal Symptoms among Pediatric and Young Adult Patients Undergoing Peripheral IV Catheter Insertion" This study examined 28 patients with a history of vasovagal symptoms during PIV insertion cared for in a pediatric surgery unit and educated to use leg crossing and muscle tensing technique. The researchers noted that a leg crossing technique is a low cost, low risk, and effective strategy to teach to pediatric patients resulting in reducing vasovagal symptoms.

Kim et al. (2005) examined adult patients who had a positive tilt test and found that leg crossing and squatting maneuver aborted an impending faint in 87% of subjects. Also, a study was done by Krediet et al. (2002) about Management of vasovagal syncope controlling or aborting faints by leg crossing and muscle tensing. This study examined 20 healthy adults and instructed them in a leg crossing combined with tensing of the leg, abdominal, and buttock muscle technique. During a tilt test, the researchers monitored blood pressure and at the moment of a fall in blood pressure they instructed participants to perform the procedure. In all subjects, the maneuver stabilized blood pressure and heart rate, relieved prodromal symptoms, and none of the subjects lost consciousness while performing the procedure.

Krediet et al. (2006) studied 9 healthy adults and showed that adults who performed leg crossing and hand gripping during a tilt challenge test had an increase in orthostatic tolerance, lower increase in heart rate, and a higher stroke volume. Van Dijk et al. (2006) conducted a multicenter randomized study of 223 adult patients with recurrent vasovagal syncope and found that patients who were trained in physical interventions, including leg crossing and muscle tensing, had a lower annual syncope burden and experienced fewer syncope recurrence compared to patients not trained in physical countermeasures.

In a review of interventions to prevent syncope, Melby et al., (2004) & Krediet et al., (2008) conclude that the leg crossing procedure is the most effective intervention. While research supports a leg crossing and hand gripping technique to decrease vasovagal symptoms and aborting impending syncope among adult patients, to date there are few studies of the effectiveness of this technique in the pediatric population. For this reason, the purpose of the current study is to determine the effects of leg crossing and hand gripping technique on vasovagal symptoms in a pediatric patient population.

Significant of study:

Several studies have examined interventions to decrease the occurrence of vasovagal symptoms and syncope in adult patients. No evidence was found in supporting interventions to implement when placing an IV catheter on a child/young adult, with a previous history of vasovagal symptoms, to reduce a subsequent vasovagal reaction. Low cost and simple to execute physical interventions, including either isometric arm contractions or lower extremity muscle tensing (Han et al., 2006; Kim et al., 2005; Krediet et al., 2002; Krediet et al., 2008 & Van Dijk et al, 2006), have been demonstrated to be effective in aborting impending syncope.

When reviewing various physical interventions, Melby et al., (2004) conclude that the leg crossing procedure is the most effective intervention. In adult samples, a leg crossing, muscle tensing and hand-gripping procedures have been demonstrated to be effective at decreasing vasovagal response to IV placement and venipuncture and this easy-to-perform maneuver has a significant clinical effect, is without any side effects or additional patient burden, and may be equally effective in combating pre-syncope and syncope (Krediet et al., 2002).

Operational Definitions:

- A Leg Crossing Technique: technique was applied to prevent Fainting by cross one leg over the other and squeeze the muscles in legs, abdomen and buttocks.
- Hand-gripping Technique: technique was applied to prevent Fainting by hold a rubber ball in the hand use to write and squeeze the ball for as long as patient can or until patients symptoms disappear.
- Vasovagal symptoms: it is symptoms that occur before children faint. A child may have: dizziness, lightheadedness, nausea, changes in his or her vision, Cold and damp skin.

Purpose of the Study:

The purpose of this study was to determine the efficacy of two simple interventions (leg crossing and hand gripping) on vasovagal symptoms associated with venipuncture in pediatric patients.

Research Hypotheses

It was hypothesized that:

1. Children who participate in the leg crossing and handgrip interventions would experience fewer numbers of vasovagal symptoms as compared patients who received standard care during venipuncture.
2. Children who receive leg crossing and handgrip interventions will be more satisfied than children in the control groups.

II. Subjects And Method

2.1. Study Design

A quasi-experimental design was utilized.

2.2. Study Setting

This study was conducted at the Emergency Department in Menoufia University Hospital, at Shebin El-Kom city. It consisted of three rooms in the first floor. No special room for children.

2.3 Sample

A purposive sample of 75 children was selected from the previously mentioned settings who requiring venous access, either for blood analysis, or to pass a catheter into a peripheral vein. They were referred by the treating physician for venous access and met the selection criteria. A simple random sample was used to assign the children into leg crossing, Handgrip and control groups. Each group equally included 25 children. Children in the control group not receive any intervention (only standard care).

Criteria of sample selection:

- **Inclusion criteria:** children who were aged 10 -17 years' old and requiring blood tests or venous access, and had report a history of nausea, vomiting, dizziness, pallor, sweating/diaphoresis, or fainting during previous IV placement or venipuncture.
- **Exclusion criteria:** Patients were excluded if they were physically or developmentally unable to actively participate in the leg crossing and handgrip interventions, sedated, unconscious or have known chronic illness (i.e. suspected or overt heart disease, sickle cell disease, diabetes, cystic fibrosis and orthostatic hypotension).

Data collection tools:-

Three tools were utilized for data collection:

1. Tool one: Social Characteristic Sheet. It was developed by the researcher to assess the social data of patients and divided into two parts as the following:

1. a. Part one: Characteristics of the children. It included data about patient's age, sex and previous history of syncope attack.

1. b. Part two: Physiological measurements. It included measuring of patient's heart rate, respiration rate and blood pressure.

Reliability

The reliability of the tool one was done to determine the extent to which items in the tool were related to each other by Cronbach's co-efficiency Alpha ($\alpha=0.822$). It reflected a high level of reliability.

Tool two: Vasovagal Signs and Symptoms Checklist. It was developed by the researcher that listed common vasovagal signs and symptoms derived from the literature and from clinical practice. The symptoms listed including nausea, vomiting, dizziness, pallor, sweating/diaphoresis, abdominal discomfort, sighing and seeing black dots. Only the three study team nurses completed the checklist. Scoring of vasovagal symptoms ranged from (0) for absent and (1) for present. ($\alpha=0.88$).

Tool three: Patient's Satisfaction Sheet. A Likert scale developed by the researchers was used. It consisted of a three point to assess children satisfaction level regarding effects of leg crossing and hand gripping techniques on reducing vasovagal symptoms during venipuncture. It was range from Unsatisfactory = 0, little satisfactory = 1 and very satisfactory = 2. ($\alpha=0.86$).

Validity

For validity assurance, the instruments were provided to a jury including three professors of pediatric nursing and assistant professors of pediatric nursing and two assistant professors in pediatrics. The modifications were done to ascertain their relevance and completeness.

2.4. Ethical consideration

Ethical Consideration for protection of human rights an oral acceptance was obtained from the children and their parents before enrolling in the study. This consent was obtained after explaining the aim and nature of the study. The study was voluntary, harmless and anonymous and confidentiality of response would be respected. All children and their parents had the full rights to participate in the study and withdraw at any time.

2.5. Pilot study

A pilot study was carried out on 10 % of the total sample (six children) after the tools were developed and before starting the data collection to test the applicability, practicability, consistency, clarity and the feasibility of the study tools and to estimate the needed time to fill the tools. The necessary modification was done for the tools, so the pilot study wasn't included in the sample.

2.6. Procedure

1. Written permission:

An official permission to carry out the study was obtained from the directors of the selected settings after submitting an official letter for the Dean of the Faculty of Nursing at Menoufia University explaining the purpose of the study and methods of data collection. Meetings were conducted first with the directors of the settings to obtain permission for conducting the research explaining the aim and expected outcomes.

2. Data collection (assessment phase)

- Data was collected over a period of 6 months starting from May to the end of December 2017.
- When patients had an order for a venipuncture and reported a history of vasovagal symptoms during previous Peripheral IV catheter insertion or venipuncture, the researcher introduced herself to the children, their parents and the nurse, who shared in the study, explained the purpose of the study and methods of data collection.
- The researcher reviewed inclusion and exclusion criteria and explained the purpose of study to the children and their parents.
- If the children qualified for the study and was interested in participating, informed consent was obtained, including assent of children under 18 years old.
- The researcher divided the children for three groups each group involved 25 patients (leg crossing group, handgrip group and control group).
- In Control group patients did not receive any intervention only routine care from emergency department care.
- The researcher was collected data from the three groups about the demographic data.
- Data collection was done daily according availability of cases at the morning shift from 8:00 Am to 2 Pm.
- The standard venipuncture protocol was carried out in the same way on the children of three groups by the same nurse.
- The researchers provided education instructions to the children about how to perform the leg crossing and handgrip procedure. This included breaking down the technique into simple steps and using visual images to explain the procedure. The researcher helped the children practice the technique prior to venipuncture. The teaching script and visual supports were designed by the study team. It was designed to use developmentally appropriate language and simplified the teaching into manageable steps for children.
- All children were attached by monitor just before venipuncture for assess blood pressure and heart rate.

3. Conducting leg crossing intervention.

The technique started by the following steps:

- Step 1: children were placed in supine position with head of the bed slightly elevated during venipuncture.
- Step 2: asked the children to cross his/her legs at the ankles.
- Step 3: asked to squeeze their buttocks together.
- Step 4: asked to use deep breathing while keeping arm relaxed.
- The researcher was ensured all children performed all four steps of leg crossing technique during the venipuncture.

4. Conducting handgrip intervention.

The technique started by the following steps:

Step 1: asked the children to hold a rubber ball in the hand that use to write.

Step 2: asked to squeeze the ball for as long as the children can or until symptoms disappear.

- The researcher was ensured all children performed the two steps of hand grip technique during the venipuncture.
- Following venipuncture, the researcher checked any vasovagal symptoms experienced by the patient that occurred during or immediately after venipuncture.

Statistical Analysis:

Data were coded, analyzed, tabled and percentage distribution was determined by using computerized statistical analysis SPSS version 21. Test of significant were applied (chi square and F test) to test significant of difference. P. value less than 0.05 & 0.001 were consider as statistically significant.

III. Result

Table (1): Characteristics of children in leg crossing, hand gripping and control groups

Characteristics	Leg-crossing group		Hand-gripping group		Control group	
	No	%	No	%	No	%
Gender						
• Male	5	20.0	8	32.0	3	12.0
• Female	20	80.0	17	68.0	22	88.0
Age group						
• School	18	72.0	20	80.0	15	60.0
• Adolescents	7	28.0	5	20.0	10	40.0
$\bar{X} \pm SD$	12.32±4.68		12.45±4.70		12.20±4.43	
Site of vein puncture						
• Hand veins	5	20.0	4	16.0	5	20.0
• Forearm veins	19	76.0	17	68.0	18	72.0
• Others	1	4.0	4	16.0	2	8.0
Type of vein access						
• Peripheral intravenous cannulation	19	76.0	17	68.0	15	60.0
• Blood draw	6	24.0	8	32.0	10	40.0

Table 1 showed characteristics of children in leg crossing, hand gripping and control groups. It was obvious from this table that the majority of children were females (leg-crossing: 80%, hand-gripping: 68 % and control group: 72%). Regarding the children's age, the majority of children were school aged with a mean age of 12.32±4.68 in leg-crossing group. In relation to site of vein puncture, the most frequently punctured site was forearm veins (leg-crossing: 76%, hand-gripping: 68 % and control group: 72%). Concerning type of vein access, peripheral intravenous cannulation was the most frequent type of vein access in the three groups.

Table (2): Comparison of vasovagal symptoms among leg crossing, hand gripping and control groups

Vasovagal symptoms	Leg-crossing group		Hand-gripping group	Control group	X ² ₁	X ² ₂	X ² ₃
	No	%					
Dizziness							
• Present	4	16.0	18	8	10.89**	2.91*	6.61*
• Absent	21	84.0	72.0	32.0			
			7	17			
			32.0	68.0			
Pallor							
• Present	3	12.0	15	5	22.62**	3.33 ^{ns}	5.92*
• Absent	22	88.0	60.0	20.0			
			10	20			
			40.0	80.0			
Bradycardia							
• Present	8	32.0	10	12	16.06**	21.33**	22.83**
• Absent	17	68.0	40.0	48.0			
			15	13			
			60.0	52.0			
Hypotension							
• Present	8	32.0	10	12	16.06**	21.33**	22.83**
• Absent	17	68.0	40.0	48.0			
			15	13			
			60.0	52.0			

Nausea • Present • Absent	2 23	8.0 92.0	19 76.0 6 24. 0	4 16.0 21 84.0	8.3 9**	1.15 ^{ns}	2.42 ^{ns}
Abdominal discomfort • Present • Absent	1 24	4.0 96.0	7 28 18 72	5 20.0 20 80.0	7.2 1**	5.56*	16.64**
Sweating • Present • Absent	4 21	16.0 84.0	5 20.0 20 80.0	16 46.0 9 36.0	3.9 9*	16.96***	5.14*
Sighing • Present • Absent	0 25	0 100	0 25 100	0 0 25 100	-	-	-
Seeing black dots • Present • Absent	12 13	48.0 52.0	16 64.0 9 36.0	14 56.0 11 44.0	23. 13**	6.62**	22.24**
Blurred vision • Present • Absent	5 20	20 80	8 32 17 68	7 28 18 72	16. 64**	14.34**	23.61**

NB: X^2_1 = leg-crossing vs control ** P < 0.001 * P < 0.05 ^{ns} no significant

X^2_2 = leg-crossing vs hand gripping

X^2_3 = hand gripping vs control

Table 2 illustrated a comparison of vasovagal symptoms among leg crossing, hand gripping and routine care groups. It was obvious that children in leg-crossing group exhibited less frequent vasovagal symptoms during vein puncture than control group (dizziness= 16%, pallor= 12%, bradycardia= 32%, hypotension= 32%, nausea= 8%, abdominal discomfort= 4%, sweating= 16%, seeing black dots= 48% and blurred vision= 20%). On the other hand, hand gripping group exhibited less frequent vasovagal symptoms during vein puncture (bradycardia= 40%, hypotension= 40% and sweating= 20%). In addition, there were statistically significant differences between children in leg-crossing, and control groups regarding vasovagal symptoms (dizziness, pallor, bradycardia, hypotension, nausea, abdominal discomfort, sweating, seeing black dots and blurred vision: p value < 0.05 and < 0.001). Meanwhile, leg-crossing group reported significant statistical differences compared to hand gripping group regarding the following vasovagal symptoms (bradycardia, hypotension, sweating, seeing black dots, blurred vision P < 0.001; Abdominal discomfort P < 0.018)

Table (3): Mean number of vasovagal symptoms among leg crossing, hand gripping and control groups

Vasovagal symptoms	Leg-crossing group (n=25) Mean±SD	Handgripping group (n=25) Mean±SD	Control group (n=25) Mean±SD	F
Occurrence of Vasovagal symptoms	1.56±2.63	4.56±3.42	6.21±2.68	F ₁ =5.14** F ₂ =52.38** F ₃ =7.53**

NB: F₁ = leg-crossing vs control ** P < 0.001

F₂ = leg-crossing vs hand gripping

F₃ = hand gripping vs control

Table 3 shows the mean number of vasovagal symptoms among leg crossing, hand gripping and routine care groups. It reported that children in the leg-crossing group experienced fewer numbers (1.56) of vasovagal symptoms than their peers in the hand gripping group (4.56) and control group (6.21). Therefore, there were statistical significant differences between the leg crossing, hand gripping and control groups (P < 0.001).

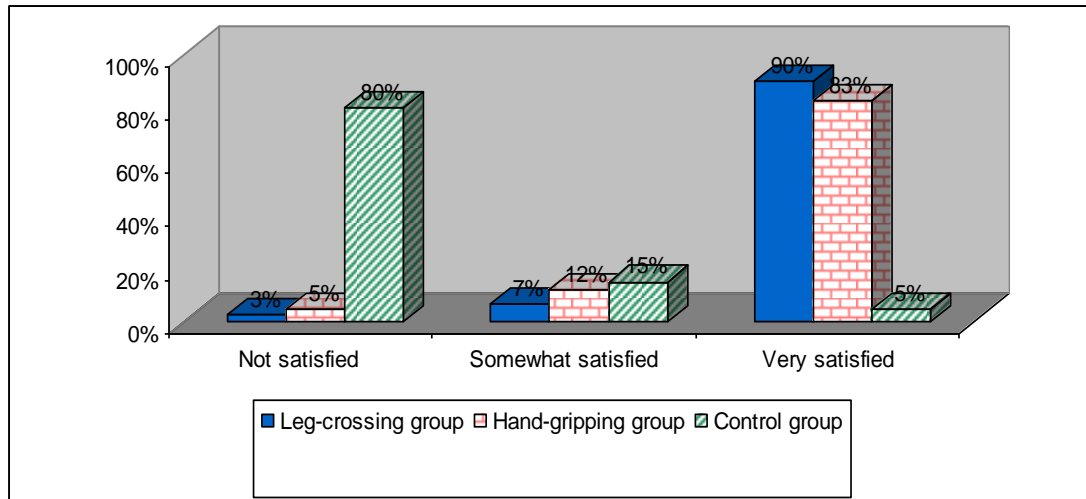


Figure (1): Children's Satisfaction regarding the effect of leg-crossing and hand-gripping techniques on reducing children's vasovagal symptoms during vein puncture

Figure 1 represents children's satisfaction of the effect of leg-crossing and hand-gripping techniques on reducing children's vasovagal symptoms during vein puncture. Approximately, all children were satisfied of the effect of the leg-crossing (90%) and hand-gripping (83%) techniques in reducing the vasovagal symptoms.

IV. Discussion

Children who are reported to have vasovagal syncope are often in need for interventions to increase the central blood volume and blood pressure, thereby giving the patient the opportunity to regain self-confidence in provocative situations. Leg crossing and hand gripping are a simple procedure that has been demonstrated to decrease or prevent vasovagal symptoms in adult. The current study hypothesized that children who participate in the leg crossing and handgrip interventions would experience fewer numbers of vasovagal symptoms as compared children who received standard care during venipuncture.

In relation to hypothesis: The present finding illustrated those children who participate in the leg crossing and handgrip interventions showed fewer numbers of vasovagal symptoms than those who received standard care during venipuncture. This might be due to a leg crossing and muscle tensing procedure has been demonstrated to be effective at decreasing vasovagal response to venipuncture. This finding came in agreement with McIntyre et al., (2018) who conducted a study about "Randomized Trial Evaluating the Effectiveness of a Leg Crossing and Muscle Tensing Technique on Decreasing Vasovagal Symptoms Among Pediatric and Young Adult Patients Undergoing Peripheral IV Catheter Insertion" they mentioned that a Leg Crossing and Muscle Tensing Technique are simple, easy perform and more effective Techniques on Decreasing Vasovagal Symptoms Among Pediatric patients.

Moreover, this result was in the same line with van et al., (2006) who conducted a study about "counter-pressure techniques for patients with syncope" They reported that counter-pressure techniques are the best interventions that prevent fainting. These findings came in agreement with Nynke et al., (2006) who conducted a research about "Effectiveness of Physical Counter pressure Maneuvers in Preventing Vasovagal Syncope" The researchers clarified that Physical counter pressure maneuvers are a risk-free, effective, and low-cost treatment method in patients with vasovagal syncope with prodromal symptoms, and should be advised in combination with current conventional therapy as first-line treatment in patients presenting with this syndrome. This might be due to physical maneuvers that can increase venous return may be able to abort the syncope attack.

Also, Kim et al., (2005) who conducted a study about "Usefulness of Physical Maneuvers for Prevention of Vasovagal Syncope" added that Squatting and leg-crossing with muscle tensing improved the hemodynamics of normal subjects as well as those of patients with vasovagal syncope. Squatting and leg-crossing can be used as a simple and effective preventive maneuver in patients with vasovagal syncope. Also, they reported that the hand grip technique didn't improve the hemodynamics, but leg crossing and squatting with muscles tensing significantly improved hemodynamics in patient with history of syncope and suggested that the leg crossing and squatting are more effective than hand gripping.

In addition, the present finding illustrated that children in leg-crossing group exhibited less frequent vasovagal symptoms during vein puncture than the handgrip group. This might be due to Leg crossing has the advantage that it can be performed as a preventive measure without much effort and without drawing much

attention to the patient's problem. Leg crossing can also be used for the prevention of hypotensive lightheadedness in the sitting position in patients with reflex syncope.

These findings were in the same line with Krediet et al., (2005) who conducted a research about "Leg crossing, muscle tensing, squatting, and the crash position are effective against vasovagal reactions solely through increases in cardiac output" they reported that leg crossing technique are a risk-free, effective, and low-cost treatment method in patients with vasovagal syncope with prodromal symptoms. This result came in agreement with McIntyre et al., (2018) who showed that a leg crossing technique is a low cost, low risk, and effective strategy to teach to pediatric patients resulting in reducing vasovagal symptoms.

Regarding children's satisfaction about the effect of leg-crossing and hand-gripping techniques on reducing children's vasovagal symptoms during vein puncture, this study showed that, approximately, all of children were satisfied with the effect of the leg-crossing (90%) and hand-gripping (83%) techniques in reducing the children's vasovagal symptoms. This is due to leg-crossing and hand-gripping techniques are feasible, safe and well accepted by the children. Also, they are effective on the body on all levels physically, mentally and even emotionally/spiritually, and low-cost treatment method in patients with vasovagal syncope.

V. Conclusion

Based on the finding of the present study, the following is concluded that

- Children who participated in the leg crossing and handgrip interventions experienced fewer numbers of vasovagal symptoms as compared to children who received standard care during venipuncture.
- Children who receive leg crossing and handgrip interventions were satisfied more than children on control group regarding the effect of leg crossing and handgrip interventions on reducing vasovagal symptoms.

Recommendations

Based on the previous findings and conclusion, the following recommendations are suggested:

1. A leg crossing and hand gripping interventions should be integrated as a part of routine daily care for children who had a past history of vasovagal symptoms.
2. In-service educational training programs about a leg crossing and hand gripping interventions should be developed and provided for nurses working at pediatric healthcare setting.
3. Application on a larger sample size and for a long period to ensure generalizability of the results.
4. Future research is needed to examine whether pediatric patients less than 10 years old would benefit from applying the technique. Additionally, to assess patient anxiety, heart rate, respiratory rate, and blood pressure to determine changes that occur during the leg crossing and hand gripping procedure.

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