Effectiveness of Valsalva Maneuver on Pain Intensity and Anxiety in Children Undergoing Hemodialysis

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ABSTRACT

Background: Children undergoing hemodialysis expose highly to anxiety and pain from frequent punctures. Valsalva maneuver is one of non-pharmacological nursing interventions to decrease pain intensity. **Aim**: The study aimed to evaluate effectiveness of Valsalva maneuver on pain intensity and anxiety in children undergoing hemodialysis. **Design:** A quasi-experimental design was used on a purposeful sample of 60 children with chronic kidney disease and undergoing hemodialysis who attended at the dialysis unit in Assiut Children University. **Method:** The present study data were collected by using a structured questionnaire sheet about personal characteristics, clinical data of children, Wong–Baker faces pain rating scale for children, physiological measures of pain and anxiety symptom scale short form. **Results**: The results indicated a highly statistical significant difference between the study group Valsalva and the control groups regarding post-test pain level (P= 0.001) as the highest percentage (63.3 %) of the Valsalva group had a mild pain level compared to only 3.3 % in the control group. A highly statistical significant difference between the groups was found regarding post intervention anxiety levels (P= 0.001) as nearly two thirds (63.3 %) of the Valsalva group had a moderate level of anxiety while, the majority (96.7 %) of the control group had a severe level of anxiety. **Conclusion:** Valsalva maneuver is an effective non-pharmacological nursing intervention in reducing pain from AVF cannulation and pain related anxiety for children undergoing hemodialysis. **Recommendations:** Using Valsalva maneuver is recommended before AVF cannulation for reducing pain and anxiety in children undergoing hemodialysis.

Keywords: *Anxiety, Children, Hemodialysis, Pain, Valsalva*

INTRODUCTION

Chronic kidney disease (CKD) is a condition characterized by kidney damage that hinders the filtration of blood resulting in the accumulation of waste substances, within the body. CKD is usually irreversible and can be progressive, meaning it gets worse over time. Common causes of CKD in children younger than five years old comprise congenital abnormalities including obstructive uropathy, hypoplastic, dysplastic kidney, and aplastic kidney. Kidney diseases in pediatric population between the ages of five and fifteen that are either inherited or acquired are frequently seen as the leading causes of CKD (Masalskienė et al., 2021).

Hemodialysis is a type of treatment that replaces the kidneys natural filtration function with equipment for effectively removing water, solutes and toxins from the blood (Canaud, Chazot, Koomans, & Collins, 2019). As a result of multiple punctures, children are exposed repeatedly to episodes of stress and pain, which are recurring symptoms and challenges in children experiencing hemodialysis. So, reducing this discomfort, pain and related anxiety could potentially enhance their acceptance to undergo hemodialysis treatment and hence improve their overall quality of life (Hothi, Laskin, & Geary, 2019).

Pain is a discomforting sensation and emotional response linked to possible harm to body tissues. Pediatric patients experience pain and stress over the disease management course. Assessing and managing pain are considered priorities in clinical nursing. To ensure pain management, it is crucial for healthcare professionals, including nurses, to be open to try new evidence-based interventions, in order to achieve the best possible outcomes (Davtalab, Naji, & Shahidi, 2017).

Anxiety occurs when experiencing a sense of worry and apprehension that arises from not knowing what might happen or being uncertain about the unknown future. Children undergoing hemodialysis experience anxiety throughout the treatment course. Moreover, pain, decreased mobility, frequent punctures and other factors may increase children' emotional distress and cause fear and anxiety. These negative, frequently encountered emotions can also significantly affect children’s health and lead to longer hospital stays. As such, pain management together with proper anxiety management is an essential step towards enhancing the children’s quality of life (Woldegerima, Fitwi, Yimer, & Hailekiros, 2018).

Sixty percent of deaths and 43% of the global disease burden are associated with chronic diseases. Children often report being anxious and having worries about their health problems relapsing or becoming worse. Fear and worries occurring as a result of living with a chronic disease has been termed health anxiety (HA). HA encompasses emotional, cognitive, perceptual, and behavioral components. In particular, HA includes distressing, intense emotions and thoughts e.g., fear, physiological arousal, and danger thoughts (Lebel et al., 2020).

Among the nursing interventions that don't include medication that aid in decreasing pain intensity is the Valsalva maneuver. It includes having the patient blows out forcefully for approximately 16 up to 20 seconds while the nose and mouth are sealed off. Such raised intrathoracic pressure resulting from the Valsalva maneuver causes baroreceptors activation, which induces Vagal nerve stimulation. As a consequence of Vagal stimulation, antinociceptive effects are elicited (Saputra, Harahap, & Kasiman, 2020). The maneuver is easy to apply, cost-effective, painless, and suitable for pediatric patients. Therefore, the Valsalva technique can be used to effectively relieve pain in children who are not responding well to medicine (Nazemroaya, Aghadavodi, Honarmand, & Ahmadian, 2021).

Nurses have a crucial part in enhancing the quality of care, ensuring sufficiency, and educating families about their child's chronic illness, in addition to identifying the treatment objectives and strategizing for the decisions that must be made as the condition advances towards hemodialysis with time. As well, they have an important role in responding to family members inquiries to prevent their children from experiencing hemodialysis-related complications. Pain assessment and management is a crucial component of professional nursing; accordingly, nurses should understand the psychological and physical repercussions of anxiety and pain and know how to appropriately handle them (Tomasello, 2018).

Significance of the study

The incidence of chronic renal disease in children differs by regions of the world. It is high in the Arab world, it is 80 to 120 cases per million population in Saudi Arabia, 225 cases per million population in Egypt and in the United States is 1.149 **(**Ibrahim & Abd El-Gawad, 2018). For pediatric patients undergoing hemodialysis, exposure to big needles in the arteriovenous fistula (AVF) site is a significant source of stress, as it occurs

frequently (about three times a week) and causes pain and skin bore exposure approximately 300 times per year. Nurses must provide pain and anxiety assessment and management in addition to their other responsibilities to these vulnerable children. It is anticipated that the Valsalva maneuver, a proven non-pharmacological technique for managing procedure pain, will be included as a supplemental treatment in the contemporary medical system. The Valsalva maneuver is an effective technique that doesn't need any special equipment, is simple for patients to learn, and lessens discomfort or pain of venipuncture in children (Rigon, Dalazen, Bissoloti, & Rabelo-Silva, 2016).

Research Hypothesis

Null hypothesis: Valsalva maneuver would have no effect on children pain or anxiety.

Hypothesis 1: Children who received Valsalva maneuver would have lower pain intensity compared to children used only the routine care.

Hypothesis 2: Children who received Valsalva maneuver would have lower anxiety scores compared to children used only the routine care.

AIM OF THE STUDY

The study aim was to evaluate effectiveness of Valsalva maneuver on pain intensity and anxiety in children undergoing hemodialysis.

SUBJECTS AND METHOD

Research Design

A quasi-experimental research design was used.

Setting

This study was carried out in the dialysis unit at the Assiut Children University Hospital.

Subjects

A purposeful sample of sixty children from both sexes who had chronic kidney disease and undergoing hemodialysis included in the study. They were divided into two groups. There were thirty patients in each group: children in the Valsalva group were exposed to Valsalva maneuver and those in the control group followed the hospital routine care. The following factors determined the sample size: a 5% confidence level in error, a 0.05 type I error, and a 95% test power. Steven Thimpson's equation was utilized to determine the sample size.

$$n = \frac{\mathrm{N} \times \mathrm{P}(1-\mathrm{P})}{(\mathrm{N}-1 \times (\mathrm{d}^2/\mathrm{z}^2) + \mathrm{P}(1-\mathrm{P})}$$

N: total society size (50), D: error percentage (0.05), Z: the correspond stander class of significant 95% (1.69), P: percentage of availability of the objectivity: (0.1), n: sample size (30)

Inclusion criteria

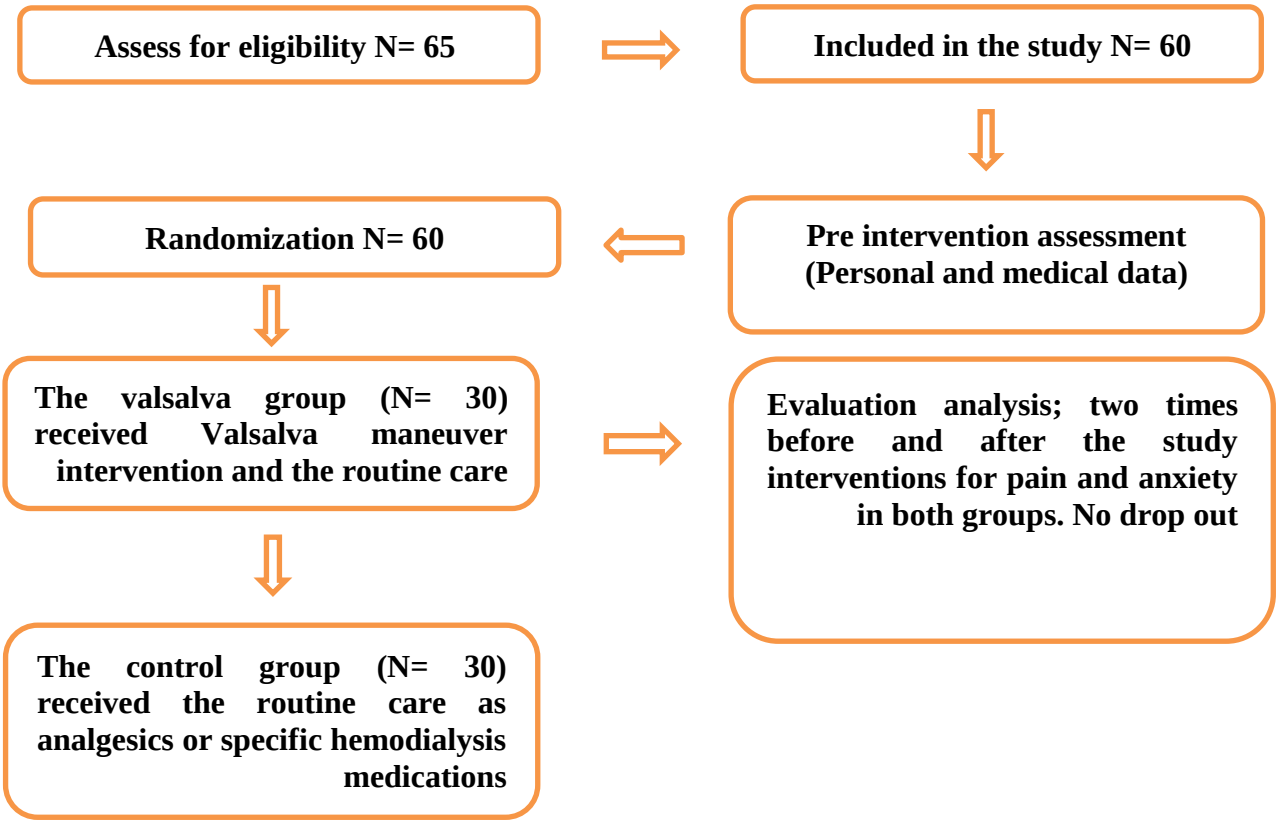
The study included children aged 6-18 years of both sexes with a healthy functioning arteriovenous fistula who had been exposed to needle puncture without interventions to decrease pain during puncture.

Exclusion criteria

- Children with inflammation, pain, redness, and bruising in the skin where needle is inserted into the fistula.
- Children on analgesic medications because of massive severe pain as they contraindicated to be manipulated or had respiratory diseases, lung deformities, connective tissue disorders, or had diabetic neuropathy, peripheral vascular diseases, altered level of consciousness and suffering from pain of other origin than AVF were also excluded.

Flow chart of the study

To show how the study interventions conducted



Tools

To accomplish this study, three tools were utilized

Tool 1: A structured interview questionnaire: consisted of two parts as following:

Part I: Personal characteristics of the studied children: such as age, sex, residence, birth order and educational level of children.

Part II: Clinical data of the studied children: included data belonged to the disease and fistula such as; hemodialysis duration in years, numbers of hemodialysis sessions per week, chronic diseases associated with kidney failure and duration of hemodialysis session.

Tool II:

(1): Wong-Baker faces the children's pain rating scale:

It is the pain scale that **Wong and Baker, (1988)** developed to evaluate the intensity of pain in children. It consists of (6) drawn faces that represent different degrees of pain, ranging from “no hurt” to “hurts worst”.

Scoring system

The Wong-Baker Pain Scale has six faces. The first face signifies "no hurt" and a pain level of 0. The second face represents "hurts a little bit" and has a score of 2. The third face represents "hurts a little more" and receives a score of 4. The fourth face represents "hurts even more" and receives a score of 6. With a pain level of 8, the fifth face implies that it hurts a lot, and a score of 10 indicates that it hurts the worst. The Wong-Baker Faces Pain Rating Scale has the following score categories: mild pain (1-3), moderate pain (4-6), severe pain (7–10), and no pain (0–).

(2): Physiological measures of pain:

This part consisted of vital signs that were measured during puncture with and without Valsalva maneuver; including respiration rate, pulse and blood pressure.

Tool III: Anxiety Symptom Scale Short Form

This scale was created by **McCracken and Dhingra (2002)** and 20 items pertaining to the symptoms of anxiety that a child may exhibit. Every item on the 5-point scale had a score ranging from 0 to 5, with the following categories: virtually never (1), occasionally (2), frequently a problem (3), almost (4), and constantly having pain anxiety sensations (5). The scale also had four subscales that corresponded to different aspects of anxiety: **cognitive** (items 1 to 5 e.g., I can’t think straight when in pain), **avoidance or escape behaviors** (items 6 to 10 e.g., I find it difficult to think about anything other than pain during painful episodes), **fear** (items 11 to 15 e.g., when I fear that something bad will happen), and **physiological anxiety** (items 16 to 20 e.g., After periods of pain, I find it hard to calm my body down).

Scoring system

The anxiety symptom scale severity score was divided into three categories: mild (0–34), moderate (35–67), and severe (68–100). Higher scores are indicative of more pain-related anxiety.

Method of data collection

- Written parents' consent was obtained after explaining the study's nature (aim, benefits, risks and procedure of the study).
- A pilot study was performed on ten percent of children (6 children) to test the application, clarity, and time required to complete study sheet. No modifications were made. So, they were incorporated into the study.

Tools validity

All tools used in the study were tested by five experts specialized in pediatric nursing for its content validity: the content validity index for tool I was 0.97, second tool's content validity index was 93%, and tool III's content validity index stood at 96%.

Tools reliability

- The internal consistency of the created tool I was examined using the Cronbach's alpha coefficient, a value of 0.90 indicated that it was dependable.
- Internal consistency of tool II was used to gauge its dependability. Cronbach's alpha coefficient has a value of 0.90.
- Additionally, internal consistency of tool III was used to assess its dependability. Cronbach's alpha coefficient had a value of 0.91.

Field Work

The study was conducted in three stages over a ten-month period, from December 2022 to September 2023:

1. **Assessment phase**

The focus of this study phase was to gather baseline data and evaluate children who fulfilled both inclusive and exclusive criteria. After getting their agreement, the

researchers interviewed the nurses, children, and parents and described the goal of the study to them.

2. **Implementation** phase: it was done through two sessions as following:

The first session

- The researchers attended during the morning shift from 8 am to 1 pm for three days per week according to the planned assessment schedule to collect necessary data that took about 15 minutes for each child.
- Each child and his/her mother (or the caregiver) were interviewed individually before receiving the intervention (Valsalva maneuver and the routine care) in the studied groups. The studied children were split up into two equal groups, with thirty children in each meeting inclusion criteria. The studied children were ordered in a list according to their admitting into the study setting, and then designated as belonging to the first group, the second number belonging to the second group, and so on. The first group received the routine care and the second group, performed the Valsalva maneuver before AV fistula insertion.
- Prior to implementing the study interventions (Valsalva maneuver and routine care) to fulfill instrument II, the researchers employed the Wong Baker Faces Pain Rating Scale to evaluate the child's pain level during the arteriovenous cannulation while they were laying on the bed.
- Following that, the child was asked roughly 20 questions about various aspects of the child's pain anxiety symptoms, such as cognitive, fear, escape or avoidance, and physiological anxiety. In roughly 15 to 20 minutes, the researchers used a numerical rating scale for tool III to assign a score to each item. Additionally, blood pressure, pulse, and breathing rate were recorded during the puncture.

The second session

- The studied children were learned to perform the Valsalva maneuver each hemodialysis session. Children were instructed to cover their nose and mouth as tightly as they can with their hand and then encouraged to try maximum expiration.
- Children who participated in the study executed the Valsalva maneuver for a maximum of five seconds, without pausing, for 16–20 seconds. The hemodialysis nurse placed the AVF after five seconds. The child performed maximum

expiration for 16 or 20 seconds during the implantation of the AVF. The researchers used the Wong-Baker Pain Scale to measure the pain of children. Pain Anxiety Symptom Scale and vital signs (respiration rate, pulse and blood pressure) were also assessed after performing Valsalva maneuver technique. The same variables were recorded for the children in (group A) after applying the routine care for control pain.

3. Evaluation phase

Evaluation was performed for children two times before and after the study interventions (Valsalva maneuver and the routine care) to evaluate and to compare the effectiveness of the both interventions on pain intensity, related pain anxiety and the vital signs as physiological measures of pain**.**

Ethical consideration

The research ethics committee at Assiut University; Faculty of Nursing approved the research proposal, code of ethical approvals: 1120240437. The research subjects were not at risk while it was being applied. The study adhered to standard ethical guidelines for conducting clinical research. Anonymity and confidentiality were guaranteed and subjects' data was used only for research purposes. Study participants were allowed to decline participation or withdrawal the study at any time, for any reason, and without consequence to themselves or their care. During data collection process, the privacy of study participants was put into consideration.

Statistical Design

Acquired data was organized, categorized, coded, tabulated, and analyzed using Statistical Package for Social Sciences (SPSS) V.26. Tables and charts were used to portray data in terms of numbers, percentages, averages, and standard deviations. To ascertain statistical significance, the Wilcoxon test was run in conjunction with the Pearson correlation between the variables. It was determined that a P-value of 0.05 was statistically significant.

RESULTS

Table (1): Indicates percentage distribution of the studied children according to their personal characteristics. It revealed that nearly two thirds (63.3 %) of children in Valsalva group were males in contrast to those in the control group in which gender was equally represented from both males and females. More than half (53.3 %) of the two groups of children were in (15 ≤ 18years) age group, mean age was (14.17±2.76 & 13.40±3.01) respectively. According to residence, more than two-thirds of children in both Valsalva and control groups hailed from rural areas (73.3 % & 66.7 %) respectively. Regarding birth order, more than one quarter (30.0 %) of Valsalva group were the first child, while more than two fifths (43.3 %) of control group were the second child. As Regards to educational level, both the preparatory and secondary levels were equally represented in the Valsalva group (40.0 %) for each level, while children in control group were equally distributed to primary, preparatory and secondary school; one third (33.3%) to each level.

Table (2): Shows distribution of studied children according to their clinical data. According to duration of hemodialysis, an exact two fifths (40.0 %) of children in both Valsalva and control groups had hemodialysis since 1- < 3 years. The study results indicated that nearly three quarters of the studied children had three hemodialysis sessions per week (76.7 % and 73.4 %) for Valsalva and control groups respectively. As well, hemodialysis session lasted for 4 hours in nearly two thirds (63.3 %) of children in the Valsalva group, however it lasted for 3 hours in more than two fifths (46.7 %) of those in the control group. Regarding associated chronic diseases, hypertension was noticed in more than half of the studied children along with chronic renal disease (53.3 % for children in Valsalva group Vs 56.7 % for those in the control group).

Table (3): Represents distribution of studied children according to mean ±SD of children's pre and post intervention vital signs in Valsalva and control groups. The study highlighted the decrease of vital signs in the post test of the Valsalva group Vs. the control group (20.23±3.04 Vs 23.87±2.39 for respiration, 121.33±14.56 Vs131.50±14.57 for systolic blood pressure, 74.33·±11.73 Vs 81.67±10.11 for diastolic blood pressure, and 79.43±7.22 Vs86.53±6.66 for heart rate) respectively. There were statistical significant differences between children in Valsalva and the control groups in the post-test with respect to respiration, blood pressure, and heart rate with (p-value of 0.001)

Table (4): Explains the relation between the degree of pain experienced by children after intervention and their personal data in the Valsalva and the control groups. The current study's findings indicated that children in the control group's pain levels varied statistically significantly according to age (P= 0.014). Additionally, the findings showed that children in the Valsalva and control groups' pain levels varied significantly depending on the length of hemodialysis (P= 0.011 and 0.001, respectively).

Table (5): reveals the relation between children post intervention's level of anxiety and their personal data in the Valsalva and the control groups. The control group results showed a statistical significant difference between levels of anxiety regarding age (P= 0.025). also, the results indicated a highly statistically significant difference between levels of anxiety regarding duration of hemodialysis in the Valsalva and the control groups (P= 0.004 and 0.001 respectively).

Table (1): Distribution of the studied children according to their personal characteristics (N=60).

Personal data	**Valsalva group (N=30)**		**Control group (N=30)**	
	N	**%**	**N**	**%**
Gender				
• Female	11	36.7	15	50.0
• Male	19	63.3	15	50.0
Age/ years				
• 6- < 9	1	3.3	1	3.3
• 9- < 12	4	13.3	4	13.3
• 12- < 15	9	30.0	9	30.0
• 15- ≤ 18	16	53.3	16	53.3
Age mean±SD	**14.17±2.76**		**13.40±3.01**	
Residence				
• Urban areas	8	26.7	10	33.3
• Rural areas	22	73.3	20	66.7
Birth order				
• First	9	30.0	8	26.7
• Second	8	26.7	13	43.3
• Third	8	26.7	7	23.3
• Forth and more	5	16.6	2	6.7
Education:				
• Illiterate	1	3.3	0	0.0
• Primary	5	16.7	10	33.3
• Preparatory	12	40.0	10	33.3
• Secondary	12	40.0	10	33.4

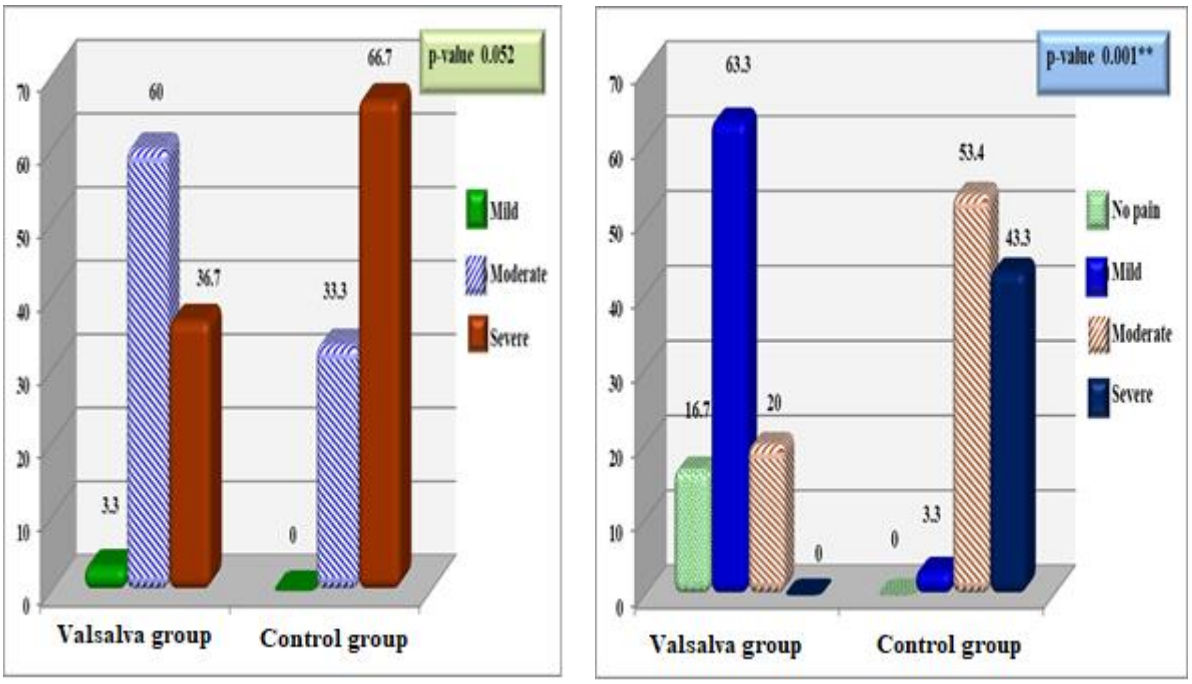
Table (2): Distribution of the studied children according to their clinical data (N=60).

Clinical data	Valsalva group (N=30)		Control group (N=30)	
	N	%	N	%
Duration of hemodialysis (years)				
• < 1	3	10.0	5	16.7
• 1- < 3	12	40.0	12	40.0
• 3- < 6	11	36.7	12	40.0
• Others (≥ 10)	4	13.3	1	3.3
Mean± SD	**2.98±2.08**		**2.85±2.04**	
Numbers of hemodialysis sessions per week				
• *Two sessions*	6	20.0	7	23.3
• *3 sessions*	23	76.7	22	73.4
• *4 sessions*	1	3.3	1	3.3
Chronic diseases associated with renal failure				
• No	8	26.7	5	16.7
• Hypertension	16	53.3	17	56.7
• Heart diseases	0	0.0	1	3.3
• Hepatic diseases	1	3.3	0	0.0
• Others	5	16.7	7	23.3
Duration of hemodialysis session				
• 2 hours	1	3.3	2	6.7
• 3 hours	8	26.7	14	46.7
• 4 hours	19	63.3	13	43.3
• 5 hours or more	2	6.7	1	3.3

Table (3): Distribution of studied children according to mean ± SD of children's pre and post intervention physiological measures in Valsalva and control groups (N=60).

Physiological measure	Valsalva group (N=30)		Control group (N=30)		Pv1	Pv2
	Mean±SD pre intervention	Mean±SD post intervention	Mean±SD pre intervention	Mean±SD post intervention		
Respiration	25.67±5.026	20.23±3.04	26.73±2.68	23.87±2.39	**0.069**	**0.001****
Systolic blood pressure	138.50±22.095	121.33±14.56	141.67±17.64	131.50±14.57	**0.296**	**0.001****
Diastolic blood pressure	85.33±12.80	74.33·±11.73	88.50±11.23	81.67±10.11	**0.316**	**0.001****
Heart rate	93.50±11.70	79.43±7.22	93.23±8.83	86.53±6.66	**0.213**	**0.001****

PV1 between Valsalva and control groups in pre test
PV2 between Valsalva and control groups in post test
(**) highly statistical significant differences
Statistical test used in this table: T-test

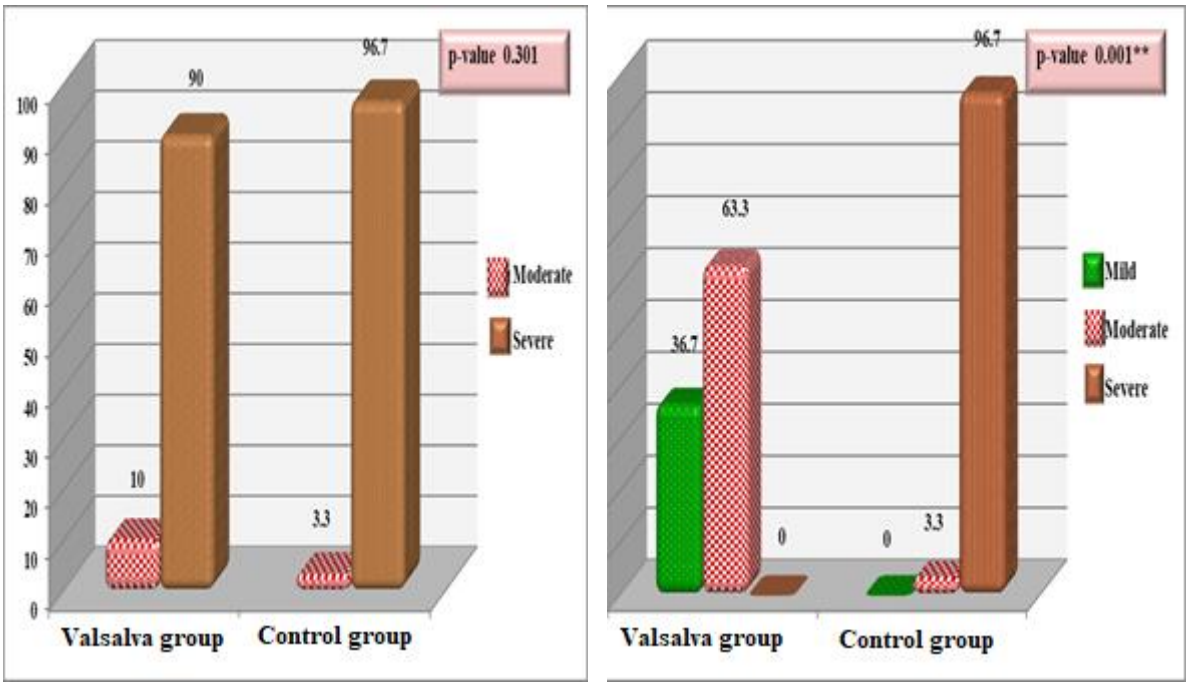


(**) highly statistical significant difference

(Pre intervention) **(Post intervention)**

Figure (1): Children pre and post intervention's level of pain in Valsalva and control groups

Figure (1) displays children pre and post intervention's level of pain in Valsalva and control groups. Regarding pre-test results, three fifths (60.0 %) of children in Valsalva group had a moderate pain level. On the other hand, about two thirds (66.7 %) of children from the control group had a severe level of pain. Regarding post-test results, it was clarified that the highest percentage (63.3 %) of children in the Valsalva group had a mild pain level compared to only 3.3 % of them in the control group. The Valsalva and control groups showed a significant statistical difference in post-test pain level (P= 0.001).



(**) highly statistical significant difference

(Pre intervention) **(Post intervention)**

Figure (2): Children pre and post intervention's level of anxiety in the Valsalva and control groups (N=60).

Figure (2) reveals children pre intervention's level of anxiety in the Valsalva and the control groups. Concerning pre-test findings, the severe level of anxiety predominates in both groups (90.0 % for the Valsalva group Vs 96.7 % for the control group). Regarding post-test results, nearly two thirds (63.3 %) of children in the Valsalva group had a moderate level of anxiety. On the contrary, the majority (96.7 %) of them in the control group had a severe level of anxiety. In addition, the results indicated a highly statistical difference between the groups (P= 0.001).

Table (4): Relation between children post intervention's level of pain and personal characteristics in Valsalva and control group (N=60).

Personal data	Children post intervention's level of pain							
	Valsalva group (N=30)				Control group (N=30)			
	No pain	Mild	Moderate	PV1	Mild	Moderate	Severe	PV2
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	
Gender								
• Female	1(20.0)	7(36.8)	3(50.0)	0.589	1(100.0)	10(62.5)	4(30.8)	0.141
• Male	4(80.0)	12(63.2)	3(50.0)		0(0.0)	6(37.5)	9(69.2)	
Age/ years								
• 6- < 9	0(0.0)	1(5.3)	0(0.0)	0.779	1(100.0)	2(12.5)	0(0.0)	**0.014***
• 9- < 12	0(0.0)	3(15.8)	1(16.7)		0(0.0)	2(12.5)	3(23.1)	
• 12- < 15	1(20.0)	2(10.5)	2(33.3)		0(0.0)	4(25.0)	8(61.5)	
• 15- ≤ 18	4(80.0)	13(68.4)	3(50.0)		0(0.0)	8(50.0)	2(15.4)	
Residence								
• Urban areas	1(20.0)	6(31.6)	1(16.7)	0.721	1(100.0)	4(25.0)	5(38.5)	0.265
• Rural areas	4(80.0)	13(68.4)	5(83.3)		0(0.0)	12(75.0)	8(61.5)	
Birth order								
• First	3(60.0)	4(21.1)	2(33.3)	0.257	0(0.0)	4(25.0)	4(30.8)	0.776
• Second	2(40.0)	6(31.6)	0(0.0)		1(100.0)	6(37.5)	6(46.2)	
• Third	0(0.0)	5(26.3)	3(50.0)		0(0.0)	4(25.0)	3(23.1)	
• Forth and more	0(0.0)	4(21.1)	1(16.7)		0(0.0)	2(12.5)	0(0.0)	
Education:								
• Illiterate	0(0.0)	1(5.3)	0(0.0)	0.875	0(0.0)	0(0.0)	0(0.0)	0.173
• Primary	0(0.0)	4(21.1)	1(16.7)		0(0.0)	5(31.3)	5(38.5)	
• Preparatory	3(60.0)	7(36.8)	2(33.3)		1(100.0)	3(18.8)	6(46.2)	
• Secondary	2(40.0)	7(36.8)	3(50.0)		0(0.0)	8(50.0)	2(15.4)	
Duration of hemodialysis session:								
• 2 hours	1(20.0)	0(0.0)	0(0.0)	**0.011***	0(0.0)	2(12.5)	0(0.0)	**0.001****
• 3 hours	4(80.0)	3(15.8)	1(16.7)		0(0.0)	7(43.8)	7(53.8)	
• 4 hours	0(0.0)	15(78.9)	4(66.7)		0(0.0)	7(43.8)	6(46.2)	
• 5 hours or more	0(0.0)	1(5.3)	1(16.7)		1(100.0)	0(0.0)	0(0.0)	

(*) Statistical significant difference
(**) Highly statistical significant difference

Statistical test used in this table: Chi-square test

Table (5): Relation between children post intervention's level of anxiety and their personal characteristics in Valsalva and control groups (N=60).

Personal data	Children post intervention's level of anxiety					
	Valsalva group(N=30)			Control group(N=30)		
	Mild	Moderate	PV1	Moderate	Severe	PV2
	N(%)	N(%)		N(%)	N(%)	
Gender						
• Female	4(36.4)	7(36.8)	0.979	1(100.0)	14(48.3)	0.309
• Male	7(63.6)	12(63.2)		0(0.0)	15(51.7)	
Age/ years						
• 6- < 9	0(0.0)	1(5.3)		1(100.0)	2 (6.9)	
• 9- < 12	0(0.0)	2(10.5)	0.097	0(0.0)	5(17.2)	**0.025***
• 12- < 15	0(0.0)	5(26.3)		0(0.0)	12(41.4)	
• 15- ≤ 18	11(100.0)	11(57.9)		0(0.0)	10(34.5)	
Residence						
• Urban areas	2(18.2)	6(31.6)	0.424	1(100.0)	9(31.0)	0.150
• Rural areas	9(81.8)	13(68.4)		0(0.0)	20(69.0)	
Birth order						
• First	5(45.5)	4(21.1)		0(0.0)	8(27.6)	
• Second	2(18.2)	6(31.6)	0.540	1(100.0)	12(41.4)	0.717
• Third	2(18.2)	6(31.6)		0(0.0)	7(24.1)	
• Forth and more	2(18.2)	3(15.8)		0(0.0)	2(6.9)	
Education:						
• Illiterate	0(0.0)	1(5.3)		0(0.0)	0(0.0)	
• Primary	2(18.2)	3(15.8)	0.527	0(0.0)	10(34.5)	0.355
• Preparatory	6(54.5)	6(31.6)		1(100.0)	9(31.0)	
• Secondary	3(27.3)	9(47.4)		0(0.0)	10(34.5)	
Duration of hemodialysis session:						
• 2 hours	1(9.1)	0(0.0)	**0.004****	0(0.0)	2(6.9)	**0.001****
• 3 hours	6(54.5)	1(5.3)		0(0.0)	14(48.3)	
• 4 hours	3(27.3)	17(89.5)		0(0.0)	13(44.8)	
• 5 hours or more	1(9.1)	1(5.3)		1(100.0)	0(0.0)	

(*) Statistical significant difference
(**) Highly statistical significant difference

Statistical test used in this table: Chi-square test

DISCUSSION

Children undergoing many hemodialysis treatments may develop fistula cannulation pain, which can result in worry, depression, and a lower quality of life. These patients may be able to tolerate hemodialysis better with effective pain treatment, which could enhance their quality of life (Obiagwu, Sangweni, Moonsamy, & Khumalo, 2018).

One of very useful non-pharmacological method for managing and lowering pain and anxiety symptoms is the Valsalva maneuver. It is simple for children to learn,

requires no special tools or preparation, and not only lessens the amount of pain from peripheral venous cannulation, but it also raises the likelihood of a successful venous cannulation insertion. In addition to being effective non-pharmacological therapies, distraction strategies can help children undergoing needle-related procedures feel less anxious and pain (Shoeibi, Mohammadi, & Pajand, 2011).

The post-intervention results of the current study showed that children in the Valsalva group's heart rate decreased much more than that of the control group. Similarly, a study by Ghods, Roshani, Mirmohammadkhani, and Soleimani (2022) titled "effects of Valsalva maneuver on pain and vasovagal reaction during the removing of femoral arterial sheath after percutaneous coronary intervention", found similar results; as the intervention group heart rate decreased significantly compared to the control group.

Regard to post intervention systolic and diastolic blood pressure, the study highlighted a highly statistically significant decrease of systolic and diastolic blood pressure between children in the Valsalva group and the control group. On the opposite, the study conducted by Ghods et al. (2022) found no significant difference between the Valsalva and control groups in terms of blood pressure. This difference between results of the two studies could be attributed to difference in patients' pain severity among the studies.

The findings of this study did not agree with those of Srivastava et al. (2021) which examined the "evaluation of efficacy of Valsalva for attenuating needle puncture pain in first-time non-remunerated voluntary plateletpheresis donors" and found no evidence of a significant difference in mean arterial pressure or pulse rate between the two groups during the procedure. The research findings indicate that there was no significant difference in pulse rate change between the Valsalva maneuver group and the control group.

A highly statistical difference between children in the Valsalva and the control groups regarding post-test pain level was indicated in the current study. This aligns with results of Suren et al. (2016) in their study that compared the use of the Valsalva maneuver with using eutectic mixture of local anesthetics to decrease venipuncture pain in pediatric population, they reported that there was a statistically significant difference in pain severity among the studied groups.

Concerning intergroup comparison of post-intervention level of pain, the current study results showed that the highest percentage of children in Valsalva group had a mild pain level compared to less than one tenth of them in the control group. The results indicated a highly statistical difference between the studied groups regarding post-test pain level. This is in line with Srivastava et al. (2021) who clarified that Valsalva group showed a statistically significant lowering in pain level compared to the control group. In the researchers' point of view, Valsalva maneuver diverts the child's attention from the painful procedure and can result in pain reduction.

The cardiopulmonary baroreceptor reflex arc can be activated by Valsalva maneuver, which may lead to decreased pain in hemodialysis patients caused by AV fistula insertion. Baroreceptor activation can trigger the Vagus nerve to transmit signals to the nucleus of the solitarius tract which is the point where the afferent nerves of the Vagus nervous system intersect with the nociceptive pathways of the spinal lamina. So that, because the AV fistula insertion also runs via the solitary tract, the Vagus nerve's impulses can block the nociceptive nerve's pain stimulation. The patient might thus feel less discomfort as a result of this (Rigon et al., 2016).

In this context, the current study results are supported by Suren et al. (2016) who revealed a significant reduction in pain intensity in Valsalva group compared to control group. Sundaran, Khan and Bansal (2016) in their study titled “an experimental study to assess the effectiveness of Valsalva maneuver prior to intravenous cannulation on pain perception among patients undergoing venous cannulation at HAHC hospital in Delhi”, indicated that Valsalva maneuver significantly decreased pain in Valsalva group compared with control group.

Furthermore, the current results were corroborated by Meenu and Balakrishnan's (2019) study, "Analogy and Collation of Valsalva Maneuver and Ball Compression on Pain during AVF Cannulation in pediatric Patients with Chronic Renal Failure on Haemodialysis" which found a statistical significant difference in the level of pain during AVF cannulation due to the positive effects of the Valsalva maneuver. Additionally, Alan and Khorshid (2022) found that patients in the Valsalva group experienced statistically significant less pain intensity during peripheral intravenous catheter (PIVC) insertion than those in the control group.

The current study found that the majority of children in the Valsalva group experienced significant pain during the pre-test, and a comparable number experienced mild pain during the post-test. The study "comparing the effects of Valsalva Maneuver and ice massage at Hoku point methods on pain intensity within the needle insertion to the AVF for patients undergoing hemodialysis" by Davtalab et al. (2017) showed a substantial difference in pain intensity before and after the Valsalva maneuver and the results stressed how crucial the Valsalva maneuver is in reducing pain intensity.

The findings also align with a study by Saputra et al. (2020), titled "Valsalva maneuver to decrease pain intensity during AVF insertion in hemodialysis patients." According to their findings, two-thirds of the subjects had moderate pain during the AV fistula insertion prior to the intervention study. Also, there was a noticeable difference between the pain level experienced due to AV fistula insertion prior to and following the Valsalva maneuver intervention.

Pediatric nurses have a crucial expert obligation to prevent pain and struggling of children in healthcare delivery by implementing multimodality non-pharmacological interventions, as recommended by the American Pain Society (Aydin, Şahiner, & Çiftçi, 2016).

Regarding children post intervention's level of anxiety in the Valsalva and control groups; the present study asserted that there was a highly statistically significant difference between the groups. About two thirds of the Valsalva group had a moderate level of anxiety compared to the majority of children in the control group had a severe level of anxiety. This may be accounted by the fact that increase level of pain increases the related anxiety symptoms.

As result of Valsalva maneuver application and its observable effect to reduced pain intensity during AVF insertion; the associated anxiety reduced consequently which clearly appeared in the decreased levels of anxiety in the Valsalva group compared to the control group as it helped them feel more comfortable during cannulation, as indicated by pain and anxiety scores. The current study results are supported by Srivastava et al., (2021) who found that the post Valsalva anxiety levels significantly reduced from their pre-Valsalva values.

According to a study conducted by Joice (2021) entitled "A study to evaluate the effectiveness of Valsalva maneuver in reducing pain and anxiety during cannulation of

AV Fistula among patients undergoing hemodialysis" there was a statistically significant difference in the post-test levels of anxiety and pain.

The current study findings indicated that the control group's levels of pain and anxiety varied statistically significantly according to age. This could be attributed to the fact that pain is a complex phenomenon that is influenced by various factors, including sensory, physiological, cognitive, affective, behavioral, and spiritual components, which can all affect the way pain is experienced. So, the older the child, the higher severity of pain is experienced, because of well recognition of pain occurrence and its sequences as discomfort and fatigue and the painful feeling from the venipuncture needle insertion. Children in pain often experience negative emotions such as fear and anxiety. Also, the level of anxiety is directly proportional to the likelihood of a child feeling pain and distress, and vice versa; especially with the little use of analgesics due to its harmful adverse effects on diseased kidneys and no distractive methods are used to manage this pain and anxiety.

Children receiving hemodialysis frequently feel anxious about getting needles inserted and having to go to the hospital three times a week for treatment. Thus, it's critical to put alternative, reasonably priced ways into practice to lessen children's unfavorable opinions regarding hemodialysis **(**Saraiva, Richards, & Fortnum, 2018).

The results demonstrated that the duration of hemodialysis is a predisposing factor in severity of pain and related anxiety symptoms which indicated by a highly significant difference between levels of pain and anxiety regarding duration of hemodialysis among children in the Valsalva and the control groups. Children undergoing hemodialysis often feel that frequently attending hemodialysis sessions take away a significant portion of their lives, leaving them with a sense of inevitability and emptiness, which can lead to negative emotional and cognitive perceptions of the world (Burrai, Othman, Brioni, Micheluzzi, & Luppi, 2019). This badly affects their perception about the more care and attention they need from their families; which can be a real burden making them more worried about the occurrence of complications, their life style change and finally, their future or even death.

A child’s response to future painful experiences can be influenced by how well their pain was managed in the past. Additionally, children who experience frequent painful episodes may become more sensitive to pain. Venipunctures sites soon become

more painful and veins become easily sclerosed. When children anticipate the next venipuncture, they may express their fear of pain again and display behaviors linked to heightened anxiety. These behaviors can significantly affect the child's perception of pain. The child's attention can be taken away from the distressing stimuli by the efficient administration of the Valsalva maneuver to significantly alleviate the pain level severity which is supported by absence of severe scores of anxiety observed among hemodialysis children in the Valsalva group compared to the control group.

This comes along the same to Ghonemy, Allam, Elokely, Kadry and Omar (2016), in their study titled "chronic pain in hemodialysis patients: role of bone mineral metabolism", who found a statistical significant difference between levels of pain regarding duration of hemodialysis. According to the researchers' point of view, this can be attributed to higher levels of pain is associated with increased hemodialysis session duration and with the results of Afifi et al., (2020) who showed a highly statistically significant positive correlation between anxiety scores and duration of hemodialysis.

Limitations of the study

The study had some limitations. The first limitation was the small sample size that matched the study criteria of children who could appropriately perform the Valsalva technique. The second limitation was the concerns of the mothers and the caregivers regarding the Valsalva technique as new method of pain control; they have never known. Finally, high degrees of severe pain could not be manipulated; other less degree cases that the physicians of dialysis unit permitted were manipulated.

CONCLUSION

The findings of the present study concluded that the Valsalva technique as a non-pharmacological nursing intervention was useful in lowering children receiving hemodialysis pain and anxiety associated with the AVF cannulation. The study indicated a highly significant difference between levels of pain and anxiety regarding duration of hemodialysis among children in the Valsalva and the control groups. This highlights the duration of hemodialysis as a predisposing factor in severity of pain and related anxiety symptoms.

RECOMMENDATIONS

- Prior to AVF cannulation, it is recommended to use the Valsalva maneuver in order to alleviate anxiety and pain in children undergoing hemodialysis.
- Pediatric nurses working in dialysis units should receive training on various non-pharmacological pain management techniques, including the Valsalva maneuver. This training can help reduce pain and anxiety in children during AVF cannulation.
- Conducting additional studies on the Valsalva maneuver is strongly recommended. These studies should include a larger sample size from diverse geographic locations, various ages, and other painful invasive procedures to achieve more generalized results.

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فعالية تقنية فالسالفا على شدة الألم والقلق لدى الأطفال الذين يخضعون لغسيل الكلى

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الخلاصة

يتعرض الأطفال الذين يخضعون لغسيل الكلى بشدة للقلق والألم من الوخز المتكرر. تقنية فالسالفا هي واحدة من التدخلات التمريضية غير الدوائية لتقليل شدة الألم. **الهدف من الدراسة:** تقييم فعالية تقنية فالسالفا على شدة الألم والقلق لدى الأطفال الذين يخضعون لغسيل الكلى. **طريقة وعينة البحث:** تم استخدام التصميم شبه التجريبي على عينة ملائمة من 60 طفلا من كلا الجنسين يعانون من مرض الكلى المزمن ويخضعون لغسيل الكلى الذين التحقوا بوحدة غسيل الكلى بجامعة أسيوط للأطفال. **الأدوات:** ورقة استبيان حول الخصائص الديموغرافية والبيانات السريرية للأطفال ، و مقياس وينج- بايكر لتصنيف الألم فى الأطفال ومقياس أعراض المقاييس الفسيولوجية للألم والقلق . **النتائج:** أشارت النتائج إلى وجود فرق إحصائي كبير بين الدراسة والمجموعات الضابطة فيما يتعلق بمستوى الألم بعد الاختبار (P = 0.001) وفرق إحصائي كبير بين المجموعات فيما يتعلق بمستويات القلق بعد التدخل (P = 0.001). كما أشارت النتائج إلى وجود فرق ذو دلالة إحصائية بين مستويات الألم ومستويات القلق فيما يتعلق بالعمر بين المجموعة الضابطة وفرق ذو دلالة إحصائية عالية بين مستويات الألم ومستويات القلق فيما يتعلق بمدة غسيل الكلى في كلا المجموعتين. **الاستنتاج :** تقنية فالسالفا هي تدخل تمريضي غير دوائي فعال في تقليل الألم الناتج عن كانيولا الوصلة الشريانية الوريدية والقلق المرتبط بالألم للأطفال الذين يخضعون لغسيل الكلى. **التوصيات:** يوصى باستخدام تقنية فالسالفا قبل تركيب الوصلة الشريانية الوريدية لتقليل الألم والقلق لدى الأطفال الذين يخضعون لغسيل الكلى.

الكلمات المرشدة: القلق، الاطفال، غسيل الكلى، الالم، فالسالفا.