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Effect of cellphone interactive games on venipuncture pain among Ill hospitalized Egyptian toddlers and preschoolers

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Abstract
Background: Venipuncture pain is one of the most fearful experience to children attending pediatric hospitals or clinics, for children it is more horrifying than the disease itself.
Aim: Explore effect of cellphone interactive games on venipuncture pain among ill hospitalized Egyptian toddlers and preschoolers.
Design: A quazi experimental research design was utilized to fit the aim of the study.
Setting: The study was conducted in pediatric surgery and medicine wards at Cairo University Specialized Pediatric Hospital.
Sample: A convenient sample of 100 child participated in the current study from the surgery ward. Subjects were assigned randomly to either control or study group.
Data collection tools: 1) Structured interview questionnaire, related to the personal characteristics of children and their mothers; 2) Pain scale: The Face, Legs, Activity, Cry, CONSOL ability pain scale (FLACC). Result: There were highly significant difference between the total pain mean score between the study group and the control group (p. less than 0.001). On the same side there was a highly significant reduction on pain intensity in the study group compared to increased pain intensity in the control group with a P. value at 0.001.
Conclusion: children who used the cellphone interactive game showed less total pain mean scores and lower pain intensity than children in control group.
Recommendation: the current study recommended that nurses to incorporate of carefully selected or even specially designated cellphone interactive games as a non-pharmacological active distraction to reduce venipuncture pain among ill hospitalized child.

Keywords: cellphone interactive games, pain, hospitalized children, venipuncture, pediatric nursing

Introduction
Hospitalization is a highly stressful experience in children and family lives. Sources of stress in the hospitalization period are enomerous; hospital environment (sounds, beds, personnel, and routines), pain, underlying disease, hospital procedures such as blood tests, cannula insertion and medical examinations are sources of stress for children. Hospital medical and nursing procedures results not in only pain but also provoke anxiety, fear, and behavioral distress in children and their families, which in turn intensify pain perception [1, 2].
Invasive procedures, particularly needle insertions, is reported by children as being the most feared aspect of attending pediatric clinics or pediatric hospital [3]. Needle insertion, or cannulation are horrifying events for any hospitalized child and for them it is even worse than the disease itself. The imagination of toddlers and preschooler children make them see the barrage of needle as if it is endless and that terrifies them [1, 2]. This wild imagination make them experience pain more vividly and even in exaggerated form. The pain experience is retrieved for longer periods and lead to magnifying of the pain intensity by the stress and anxiety. They tend to express pain in loud crying and tears and their fear of pain make the problem even worse [1, 2, 3].
Pain is a subjective experience with cognitive, behavioral, and emotional dimensions which is affected by environmental, socio-cultural, and evolutionary factors of an individual. 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. The pain resulted from medical procedures is one of the stressful and scary experiences in children [3] Despite medical advances in the assessment and management of pain in the past years, children reported moderate to severe pain levels [4].
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, psychological depression", delayed recovery and prolonged hospital stay [3, 6] 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]. Therefore, managing the pain resulted from procedures associated with needle therapy is one of the therapeutic priorities [4] 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 [5, 6].

Treating pain reduces anxiety during procedures, and can decreases the need for physical restraints, reduces anxiety regarding subsequent procedures, and prevents short and long term consequences of inadequately treated pain. Pain management is achieved by the use of pharmacological or non pharmacological methods [7, 8, 9]. Non pharmacological techniques help in coping with pain and give children an opportunity to feel a sense of mastery or control over the situation [8].

Pediatric nurse is the sole responsible person to provide procedures to ill hospitalized children [10]. They insert venous or cannula, withdraw blood samples, apply wound dressing, assess pain level of the child, report it as a fifth vital sign and provide care of it [11]. Because of that most of the researches that examine new non-pharmacological pain management practices are made by nurses to help their pediatric patients to cope with pain in a better way and to reduce both the destructive effect of pain as well as the need to pharmacological pain killers and their systemic effect on body organs[12]. The effective management of pain is, after all, a fundamental human right and one of the pediatric nurses responsibility is to provide pain free nursing care for children [7, 13, 14].

Distraction is a simple technique which does not require any specific training and can be implemented by nurses, parents or other health care personal besides, it has a minimal cost and implies no risks for the child [9]. Distraction is often used by nurses and parents to reduce procedure pain among children. It has two forms: active and passive. Active distraction requires the child's attention and engagement such as playing awhile the passive distraction require only watching such as television watching or listening to music [10, 15, 16].

Significance of the study

Cell phones are spread everywhere, they are used and even abused. A lot of researches were done to explore its negative impact on children health and only few started to explore the possible good uses of it in relation to child growth and development. However; playing with an interactive game is considered an active method of pain distraction [14]. Even though the field of virtual reality/video games, computer games, mobile or tablet games are the hope of future non-pharmacological active distraction pain management world-wide among pediatric as well as adult patients, still this technique in under-explored and even underused by the Egyptian pediatric nurses in a way that is helpful in pain reduction.

Operational Definition

For the purpose of the current study the following definition of terms is used:

Cell phone interactive game: For this study the researcher used a bubble game with attractive colors when the child tap on the phone screen it explodes and when reaches a specific score (pre-indicated by the game developer) the screen show a celebration with cheerful multicolor.

Venipuncture pain: It is the pain results from venous blood sampling or venous cannula insertion.

Aim of the current study

This study aim to:

Explore the effect of cell phone interactive game on venipuncture pain of ill hospitalized Egyptian toddlers and preschoolers.

Methods

Research hypothesis

1. Ill Hospitalized Egyptian Toddlers and Preschoolers who play with cellphone interactive game will show lower FLACC total mean pain score than children who did not play.
2. Ill Hospitalized Egyptian Toddlers and Preschoolers who play with cellphone interactive game will show lower FLACC pain intensity than children who did not play.

Research questions

What is the effect of cellphone interactive game on the venipuncture pain among ill hospitalized Egyptian toddlers and preschoolers?

Research Design

Quazi experimental research design was utilized to fit the aim of the study. A quazi-experimental design is one type of effective research design that is very helpful to the true experimental design except for either complete laboratory control on the extraneous variables that might affect the results or randomization which affects the generalizability of the results [17].

Setting

The study was conducted in pediatric surgery ward at Cairo University Specialized Pediatric Hospital (CUSPH).

Sample

A convenient sample of 100 children with surgical diagnosis participated in the current study.

Subject assignment

Children were randomly assigned to either research or control group.

Inclusion criteria

- Children age from more than 2years – and less than 6 years.
- Children complain from surgical problems.
- **Exclusion criteria**
- Children with any disabilities.

Ethical Considerations

The written consent was obtained from the mothers of the children after clear explanation of the purpose and nature of the study in order to obtain their acceptance as well as their cooperation. The researchers assured mothers that all data gathered during the study are confidential and that they can

withdraw from study without any effect on the care provided to their children.

Data collection tools: The required data was collected through the following two tools.

1. Structured interview questionnaire: It developed by the researchers, it includes 13 questions and composed of two parts: -

Part I: to assess personal characteristic of children and their mothers and it involved four (4) questions about the children such as (age, gender, rank and diagnosis) and it also included five (5) questions about the mother's characteristics such as (age, education level, employment, place of residence, number of sibling).

Part II: -It contains 4 questions about disease history such as (disease duration, hospitalization period, hospitalization reaction and hospitalized phase).

2- Pain scale: The Face, Legs, Activity, Cry, Consolability pain scale (FLACC), this behavioral pain scale was developed by the anesthesiology, university of Michigan Medical school and health system is a valid and standard instrument and it has been used in several studies [18].

Scoring system

Children's behavioral pain scale (FLACC) is used to determine the severity of pain in children during and after venipuncture procedures based on children's behavioral responses. This scale including 5-section composed face, legs, activity, crying and the ability to relief. Each section accounts for 0-2 scores. Higher scores indicate bigger responses to pain. The scores of each section were separately recorded and then were summed to calculate the total score of pain. The range was from 0 to 3 (slight pain), from 4 to 7 (moderate pain) and from 8 to 10 which indicates severe pain.

Validity and Reliability

Data collection tool (the structured interview sheet) was submitted to five experts (three from pediatric nursing field and two psychologists) to test the content validity. Modifications of the tools were done according to the experts' judgment on clarity of sentences, appropriateness of content and sequence of items. The experts' agreed on the content but recommended minor language changes that would make the information clearer and more precise.

Data Collection Procedures

Before conducting the study an official permission was obtained from the directors of CUSPH, and permission from the head of surgery ward also was obtained after explaining the nature of the study. The researchers introduced self to the mothers and their children. Acceptance was obtained from mothers of children in the study according to inclusion criteria. Clear and simple explanations about the aim and nature of the study were discussed by the researchers with mothers, then mothers filled structured interview questionnaire.

For the study group, before the venipuncture, the researcher teach the mother about the game and how to play it, then give to her the cellphone, during the venipuncture time the mother start to show the game and play it in front of child, then immediately after that give the phone to the child to continue playing. During that time the researcher measure the FLACC score one time during the venipuncture and 10 minutes later. Then the mean score is calculated for each child and the pain intensity is identified.

For the control group the researcher observed the child during the venipuncture and 10 minutes after it and calculate the mean score for the two separate observations and indicate the pain intensity accordingly. However, the researcher gave the children in the control group time to play with the cellphone interactive game without assessing their response out of humanity and teach the mothers in both groups about the importance of active distraction in reduction of stress and pain for children.

The time needed for each child ranged from 30-45 minutes including the questionnaire, venipuncture procedure, and play with the cellphone interactive game. Data collection was conducted over three months extending from January 2019 till March 2019. Mothers were interviewed in the nurse station area to ensure being able to concentrate and reply to questions fairly while the child play started immediately after venipuncture either in the nurse station or in his/her own bed.

Pilot study

Pilot study was carried out on 10 children to assess the feasibility, objectivity, applicability, clarity, adequacy, and content validity of the study tools and time required to fulfill its aim and to determine possible problems in the methodological approach or instrument. The results of the pilot study were used to test the proposed statistical and data analysis methods. The tools were completed without difficulty, adding support to the validity of the instrument. The pilot study was included to the total sample.

Statistical analysis

The collected data tabulated, and summarized. A statistical package for social studies (SPSS) version 20 was used for statistical analysis of data. Data was computerized and analyzed using appropriate descriptive and inferential statistical tests. Qualitative data were expressed as frequency and percentage. Mean and SD were used to evaluate the quantitative variables (age) and absolute and relative frequency was used to evaluate the gender. Independent T-test was used to assess changes in mean pain between the two groups. The Chi-square test was used to compare pain intensity between the two groups and correlation coefficient to test relationship between pain mean scores and selected variables in the children and their mothers. In this study, a significant level of $P<0.05$ was considered.

Results

Table 1: Children personal characteristics in the study group (n=50) and control group (n= 50).

Item	Study group		Control group		Test	P. Value
Age/years	**No**	**%**	**No**	**%**		
2->4	28	56%	30	60%	X2=4.119	0.249
4->6	22	44%	20	40%		
Gender						
Male	27	54%	26	52%	X2=0.453	0.501
Female	23	46%	24	48%		
Diagnosis						
Hirschsprung disease	10	20%	12	24%	X2=1.453	0.411
Appendicitis	13	26%	10	20%		
Renal stone	10	20%	9	18%		
Vesicoureteral reflux	7	14%	9	18%		
Duration of Venipuncture in minutes	Mean ± SD 6.92±1.071		Mean ± SD. 6.70±0.966		t. =0.986	0.313

Table (1) showed that both the study group and the control group were homogeneous in relation to age as more than half of both groups aged between 2 and less than 4 years old and Chi. Square=4.119 with p. value =0.249. Sex: more than half of either study or control group was male and Chi. Square= X2=0.453 with p. value = 0.501.In relation to diagnosis Hirschsprung disease was the highest percentage in both study and control groups with X2=1.453 and P. value = 0.411 and mean time of duration venipuncture was 6.92+1.071minutes for study group and 6.70+0.966 minutes for control group; with a t. = t. =0.986 with no significance difference.

Table 2: Mothers children personal characteristics in the study group (n=50) and the control group (n=50).

Item	Study group		Control group	
Age in years	**No**	**%**	**No**	**%**
>20	10	20%	9	18%
20 >30	12	24%	12	24%
30>40	15	30%	17	34%
40 and more	13	26%	12	24%
Place of residence				
Urban	27	54%	28	56%
Rural	23	46%	22	44%
Level of education				
Not read and write	17	34%	15	30%
Secondary school education	20	40%	23	46%
University education	13	26%	12	24%
Occupation				
House wife	30	60%	28	56%
Working mother	20	40%	22	44%

Table (2) concluded that less half of the mothers in both the study and control groups aged 20>40 years old. Almost two fifths of the mothers are graduated from secondary schools in both groups. More than half of the mothers in both study and control group were house wives (60% and 56% respectively) and more than half of them (54% and 56% respectively) lives in urban areas.

Table 3: Percentage distribution of disease history of children in the current study (n=100).

Item	Study group		Control group		Chi Square Test	P. Value
Length of hospital stay	**No**	**%**	**No**	**%**		
1->2 weeks	28	56%	30	60%	0.353	0.422
2-4weeks	22	44%	20	40%		
Child reaction to hospitalization						
Looks quite	14	28%	19	38%	4.553	0.211
Nervous/restless	17	34%	12	24%%		
Afraid medical staff	13	26%	14	28%		
Afraid any stranger	6	12%	5	10%		

Table (3) highlighted that more than half of children in both study and control group (56% and 60% respectively) were hospitalized for less than two weeks. Regarding children reaction to hospitalization, it was found that 34% in study group look nervous and restless while 38% of the children in control group looked quite. However, there was no significant differences between the study and control group regarding the duration of hospitalization or hospitalization reaction.

Table 4: Hospitalization stressor affecting children in study group (n=50) and control group (n=50).

Hospitalization stressors	Study Group		Control Group		Test	P. Value
	No	**%**	**No**	**%**		
Physical environmental	24	48%	25	50%	0.457	0.522
Psychological	26	52%	25	50%		

Table (4) revealed that 48% of children in the study group suffered from physical and environmental stressors (as pain, light, sounds, uncomfortable bed …etc) while half of children in the control group has the same stressor. The chi square test showed homogeneity between the two groups with a value of 0.522.

Table 5: comparison between the children mean pain score in the study and control group after the intervention.

Before	Study Group	Control Group	T. test	P. value
Mean Pain Score ± SD	2.65 ±1.567	7.95 ±1.094	17.505	0.001

The mean and standard deviation of the score of behavioral responses to pain in the control and intervention group were 7.95 ± 1.084 and 2.65 ± 1.567, respectively (Table.5). There was a significant difference between the two groups in terms of pain (P<0.001).

Table 6: Comparison between the children pain intensity in the study and control group after the intervention.

Pain Intensity	Study Group		Control Group		X2	P. value
	No	%	No	%		
Low=0-3	38	76%	0	0%	10.827	0.001
Moderate=4-7	12	24%	15	30%		
Severe=8-10	0	0%	35	70%		

Seventy percent of children in the control group experienced severe pain, but most children in the intervention group (76%) had a low pain. There was a significant difference found by Chi-square test in terms of pain intensity between the two groups (P<0.001) (Table6).

Table 7: Correlation between the mean pain scores of children during the venipuncture their characteristics.

Item	Mean Pain Score	
	r.	P. value
Child age	-0.72	0.03
Length of Hospital stay	0.88	0.05
Mother age	-0.91	0.01

Table (7) specified the negative correlation between the child age and mother age from one side and the mean pain score from the other side (the lower the age of child or mother the higher the pain score) with a p. Value of (0.o3 and 0.01 respectively). The same table highlighted the presence of highly significant correlation between length of hospital stay and the mean pain score for the children with a p. value of 0.05.

Discussion

The study at hand shed light on one of the most important problems that faces nurses, mothers and children in hospital time which is children reaction to hospitalization. The reactions recorded in the sample were: looks quite, nervous and restless, afraid of medical staff, afraid of any stranger. These reactions are very understood on the light of the complete absence of preparation programs to children and their parents before hospitalization in Egypt.

Hospitalization looks as a house of horror for both children and their parents. They get brief instructions and orders from doctors, nurses, or any working staff, but no information, no understanding of what will happen and why and how to deal with either on the physical or psychological level. The results of this study goes in harmony with the deeply rooted literature that emphasize on the fact that children and their family are in need for great support to face and deal with the hospitalization time and this only can be offered by the nursing as well as medical staff so that the reaction is healthy or guided into healthy path as much as possible [1, 2].

This study found that both physical stressors (pain, sounds and lights, etc.) and psychological stressors (fear, separation from beloved ones, etc.) are almost affect children equally. Actually it is difficult to separate physical sources of stress from psychological in the hospital. What starts as physical like sounds and lights can open the door of memory about how the bed at home felt like and favorite toy that a child used to sleep while hugging it and how much they miss their siblings and routines. Same thing happen when the psychological stressors start to attack the child like fear or separation anxiety this will magnify the feeling of the physical stressor as pain or discomfort. These findings matched the findings of Ramsdell, Morrison, and Marsac, (2016) [27].

Here in this research the total mean pain scores in the study sample were highly significantly lower than those of the control group. These results are similar to those of HeHG *et al*., in 2015 [9]; in their randomized controlled trial therapeutic play intervention was used and subjects reported a significant reduction in the postoperative pain. This finding also is on the same side of Abd Allah and Mohamed (2018) who mentioned that the mean children's behavioral pain score in active distraction group before and after applying distraction technique was lower than it in passive distraction and in no distraction group and there was statistically significant difference between before and after applying distraction technique in both distraction groups.

Abd Allah and Mohamed (2018) also indicated that the mean children's behavioral pain scoring in no distraction group was higher than both active and passive distraction groups and there was a statistically significant difference between mean of children's behavioral pain scoring in the three groups [19]. Beside, Kaheni and Rezai (2016) [6-20] reached to the same result who illustrated that mean children's behavioral pain response scoring was higher in no distraction group than active distraction group there was a significant difference in the score of behavioral responses to pain between the two groups [20].

The pain intensity was significantly lowered in the study group and that is typically supported in the work of Elsayed, Bahgat and El-Afifi (2018) [11] when they studied on 75 hospitalized school age children to determine the effect of active versus passive distraction technique on controlling pain associated with invasive nursing procedures and found that there was statistically significant difference between pain intensity in active and passive distraction groups and between control groups. In relation to, the mean total behavioral distress among children was lower in active, passive distraction groups than no distraction group with a statistically significant difference between them. There is a wide range of growing evidence about the use of smart applications on smart tools as iPods, cell phones and tablets to reduce pain among pediatric patients [24, 25, 26]. Pain and age the present study indicated that there was negative non-significant correlation between pain intensity and age of

school aged children in both distraction and no distraction groups. This result was consistent with Tufekci and Kucukoglu (2017) [21] who found that there was a moderate negative correlation between the age of school age children and pain severity in the distraction and no distraction groups [21]. Shivcharan and Deshpande (2016) [7-22] disagreed and proved that none of the demographic variable was found to have significant association with the level of pain among children undergoing veinpuncture either in control or experimental group [22]. This result was matched with Kaur and Sarin (2014) [23] who mentioned that there was inverse relationship between the behavior pain response and the age of the child [23].

In this study we found that mean pain scores of children are significantly negatively correlated with mothers age, hi finding is in accordance with Brodwall, Glavin, and Lager (2018). They studied parents' experience when their child has chronic abdominal pain: a qualitative study in Norway and found that the younger the age of the parents the less experience age they have in relation to pain management methods that could help their children [28]. The current study found a highly significant correlation between mean pain scores and length of hospital stay even though Elsayed, Bahgat and El-Afifi (2018) [11] found no relationship between them the results could be understood on the light of the fact that length of time that a person is subjected to stressors make this person more sensitive and exaggerate both perception of and reaction to stressors. These children when they spend long periods in the hospital, they are subjected to numerous stressors and they have little or no support except for their mothers who are depleted because they are affected with the same stressors and even much more other stressors related to their family responsibility and work. It is totally understood that such stressors could lead to increase in the pain scores and intensity.

Conclusion

The at hand study concluded that:

Ill Egyptian hospitalized toddlers and preschoolers react to hospitalization by either looking quite, nervousness and irritability, fear from medical staff and strangers. They are affected equally by physical stressors (as pain, light, sounds, etc.) and psychological stressors (as fear, sadness, anxiety separation etc.). The FLACC total mean scores pain scores and pain intensity level of study group are lower than the control group with a highly significant P. value=0.001. The FLACC total mean pain score is negatively correlated with child and mother age and positively correlated with the length of hospital stay with a highly significant P. value.

Recommendations

The current study recommended the following:

1. Duplication of the study on bigger sample and with random sampling technique.
2. Integration of active distraction non-pharmacological pain management methods namely cellphone interactive games in the field of pediatric pain management.
3. Train pediatric nurses on the use of non-pharmacological pain management techniques namely cellphone interactive games in the field of pediatric pain management

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