

Effect of Infusionarium on Occurrence of Selected Physical and Emotional Complications among Children undergoing Chemotherapy

¹Faransa Ali Ahmed Hassan, ²Safaa Rashad Mahmoud,
³Ola Ali Abed El-fatah Ali Saraya

¹Lecturer of Pediatric Nursing, Faculty of Nursing, Assiut University, Egypt

²Assistant. Prof. of Community Health Nursing, Faculty of Nursing, Assiut University, Egypt.

³Lecturer of Psychiatric Nursing, Faculty of Nursing, Suez Canal University, Egypt

Abstract: Background: Chemotherapy treatment can be a traumatic experience for adults, imagine for kids. Due to adverse effects of cancer treatment on children's mental health, chemotherapy side-effects and positive effects of infusionarium therapy on nausea, vomiting and stress. Purpose: this study was aimed to determine the effect of infusionarium on occurrence of selected physical and emotional complications among children undergoing chemotherapy. Methods: The present study is a quasi-experimental research design done on 60 children undergoing cancer chemotherapy in South Egypt Cancer Institute - Assiut University in Egypt from December 2015 to December 2016. By convenience sampling method and then allocation, they were randomly divided into two groups (30 children for each group aged from 3-12 years old) as control and experimental. The data included the demographic questionnaires, all indices of nausea and vomiting were measured by two scales and stress self-assessment questionnaire. Nausea and vomiting and stress questionnaire was performed before and after chemotherapy course. Results: Approximately all indices of nausea and vomiting significantly reduced during and 2hrs post-chemotherapy by infusionarium and exhibited it is as a useful technique for control of nausea and vomiting in children. Significant difference was found between the control and experimental low stress level in the two groups during chemotherapy ($p=0.035$), there were more than half of infusionarium group children have low stress level compared to 26.6% of control group children at the same level. This shows the positive and efficient effects of infusionarium in reducing the stress during chemotherapy of the children. Conclusions: infusionarium therapy reduced chemotherapy-induced nausea, vomiting and stress level among children with cancer. Recommendations: Conduct progressive and permanent studies on infusionarium in specific alternatives since infusionarium has better effects on decreasing nausea, vomiting and stress before and after chemotherapy.

Keywords: Infusionarium, Physical, Emotional, Complications, Children, Chemotherapy.

1. INTRODUCTION

Firstly infusionarium considered of as a "best healing place" for children with cancer, infusionarium trusts the words infusion and aquarium to create an immersive environment where children can have some positive relations with treatment. Infusionarium is creating a best healing environment for hospitalized children. The infusionarium is a cooperating treatment interplanetary that uses the newest audio-visual tools in a hospital environment (Stiegelis et al., 2013).

The Infusionarium is the Children's Hospital of Orange County's in England latest effort to normalize the arduous visits and wanted patients to have some positive associations with treatment, to sensation more whole. Many children said, "Could I get my infusion in an aquarium?" so they connected the infusionarium (infusion and aquarium). It help child to

engage with one another, or join with friends and family. The treatment chairs provide access to five broadcast channels, including social media, video games and movies. Infusionarium gives them a calm place to suspend out with one another. Staff members have distinguished that children who use the infusionarium need for less medication for nausea, anxiety and vomiting. In fair a children can go from feeling anxious about their treatment to being stressful while learning about space or another topic of interest (**Holzberg, 2015**).

Children are sitting for hours with a needle inserted and are attached to a bag of fluids for hours at a time. During infusionarium children does not look at all like a hospital room with its bright colors and giant screen. It looks more like a theme park or home theater than a hospital treatment room (**Peck and Boland, 2015**).

Infusionarium has a significant effect on the level of anxiety, pain, vomit and vital signs of the children under surgery in Mansoura University Children's Hospital at Egypt. Also, there was a meaningful difference between the sample and non-sample cases after infusionarium in decreasing pain, anxiety, vital signs of children under surgery (**Mohamed et al., 2017**).

Although its many advantages described over two decades ago, chemotherapy-induced nausea and vomiting (CINV) are the greatest unwanted and common side effects of chemotherapy among children suffering cancer treatment. The incidence of nausea and vomiting are not only unsuitable and unwanted, but also cause pulmonary and metabolic special effects, nutritional insufficiency, dehydration, acute renal failure, and weakness. CINV is an essential cause of troubling the normal form of cancer treatment and can affect children's readiness to continue chemotherapy course (**JakobsenandHerrstedt, 2011**).

Nausea and vomiting are the greatest public and disagreeable side effects of chemotherapy, and they may prevent treatment accomplishment. Anti emetics admin is vital and considered the suitable method to decrease nausea and vomiting, but they are not beneficial for all children and repeatedly cause undesirable side effects including agitation, dizziness, anorexia, hypotension, arrhythmia, and rash, which can increase the problems in the children. Anti emetics not only cannot prevent nausea and vomiting totally but also have many side effects. So it is necessary to find other methods for a better control (**Slatkin, 2014**).

Mainly for a child, such visits can be among the greatest physically and emotionally fatiguing of a demanding routine that can go on for years. After needles are inserted, anxieties leaking into children bodies (**Bradt et al., 2014**).

Recently, complementary treatments are gradually combined into cancer programs and many of people that use complementary and alternative medicine have increased. This new technology and programming offer in cancer children's hospital with a completely new way to provide a distraction, a sense of normalcy and to help mitigate what can be the harsh side effects of illness and hospitalization (**Myers et al., 2016**).

Multi-disciplinary team they are includes pediatric, community, psychiatric nursing have renewed their services to encourage social communication among children with cancer. They applied infusionarium by prepare areas for children where they can engage with other children and not feel alone during treatments (**Shaban et al., 2015**).

Nurses use infusionarium to give children skills that allow them to feel well while they are waiting tolerantly when treated. The Infusionarium was created to modification that perception. It looks more like it belongs in a theme park but the main purpose is to use these technologies to offer kids experiences that allow them to feel better while they are waiting patiently and being treated (**Mottahedian et al., 2014**).

2. SIGNIFICANT OF THE STUDY

According to the **National Cancer Institute (2016)**, about 16,000 new cancer cases will have been diagnosed this year in infants and children up to 19 years old. On any given day, thousands of these children are receipt chemotherapy at outpatient infusion clinics. Children are also treated with infusions for other diseases, including Crohn's disease, juvenile rheumatoid arthritis, sickle cell anemia and immune disorders.

In recent times, data directors in National Cancer Institute of Cairo University, Pediatric Oncology Hospital in Cairo, and South Egypt Cancer Institute of Assiut University stated incident of pediatric cancer cases among populations of the 3 governorates that were diagnosed/treated in these institutions at Egypt that the over-all cancer occurrence rate enlarged

during the last 10 years. The incidence of lymphatic increased approximately 11 times cancer incidence. The incidence of leukemia among infant less than 5 years increased exponentially with a higher incidence among boys (Sherif and Ibrahim, 2016).

Infusionarium was created to change the environment in which children received chemotherapy and help them in reduce the physical side effects as nausea and vomiting and decrease stress level will managed by infusions from cancer.

The operational definition of selected physical and emotional complications and Infusionarium:

- **Nausea** is feeling sick to child's stomach, as if the food he/she ate is going to come back up (Jordan et al., 2016).
- **Vomiting** is when this actually happens. Food, liquids, and anything else in his stomach comes back up. "Throwing up" is another name for vomiting (Jordan et al., 2016).
- **Psychological stress** describes what children feel when they are under mental, physical, or emotional pressure. Stress can be caused both by daily responsibilities and routine events, as well as by more unusual events, such as infusion of chemotherapy, children who experience high levels of psychological stress or who experience it repeatedly over a long period of time may develop health problems (mental and/or physical) (Behrman et al., 2012).
- **Infusionarium** is a system designed to helps children undergoing procedures and treatment such as chemotherapy, dialysis, radiation therapy and more through fully immersive interactive treatment space in a hospital room including bright colors and giant screen social media, video games and movies (Laguna and Calif, 2017).

3. AIM OF THE STUDY

This study was aimed to determine the effect of infusionarium on occurrence of selected physical and emotional complications among children undergoing chemotherapy

4. RESEARCH HYPOTHESIS

Children who will receive chemotherapy in infusionarium room will have less physical (nausea/vomiting) and emotional (stress) chemotherapy complications than those in the control group.

5. MATERIALS AND METHODS

Study design: The present study utilized quasi-experimental research design.

Setting: Children with cancer that referred to South Egypt Cancer Institute-Assiut University in Egypt for chemotherapy in pediatric out patient's clinic from December 2015 to December 2016 and had a file there.

Sample & sampling technique:

The final study sample included 60 child diagnosed cancer by an oncologist and no any disease other than cancer, being 3-12 years old and undergoing chemotherapy in the outpatient clinic of South Egypt Cancer Institute in Assiut city. The children were randomized sequentially to the two groups (30 children for each control and intervention group)

Randomization was done with considering the child's first application day of the week to the chemotherapy clinic. Children who came on the 1st day of a week were received to intervention group; groups were created as 1 day experiment and 1 day control (Sunday-experiment, Monday-control, Tuesday-experiment, and Wednesday-control). The experimental and control groups of children received the same chemotherapy cycle.

Exclusion criteria included: diagnosed psychosomatic disorders, loss of consciousness, gastrointestinal, hearing or vision problem, nervous system cancer or children using sedatives or opium drugs.

Ethical consideration:

Research proposal was approved from Ethical Committee in the Faculty of Nursing – Assiut University and here is no risk for study subject during application of the research. The study followed common ethical principles in clinical research. Written consent was obtained from the parents of children before participated in the study and after explaining the nature and purpose the study. Privacy and secrecy was confident and children' parents have the right to refuse to participate.

Tools:

Three tools were used to collect the necessary data:

Tool (1): child basic data structured interview schedule: This tool was developed by the researcher after reviewing the related literatures. It entailed the following two parts; *first part* : (personal data or demographic data) (age, sex and residency), *second part* related to type of diagnosis and duration of the disease.

Tool two; Barf, 2011 (Baxter Animated Rating Face) scale was used for 3-9-year-old children and **Visual Analogue Scale (VAS) (Boogaerts et al., 2000)** for 9-12-year-old children to assess nausea and vomiting severity. Then we decided to use the Barf scale for 3-9-year-old children. Barf is a self-report graphic active ranking face scale used for assessing nausea and vomiting in children less than 9 years of age. It has 6 faces showing the degree of nausea. 4-item ranking scale was used to evaluate vomiting severity.

Tool three: assess children stress symptom by **Sharrer–Wenger (2002)** scale were used to gather data. It's a 24-item self-report questionnaire with 11 items about the enthusiasm symptoms and 13 items for the physical symptoms of stress, each question has two ranges " there is (1 score) and there is not (0 score)".

The scores of stress symptoms ranged from 0 to 26 and stress symptoms were reported in 3 levels of low, medium and high. A total score was obtained by adding scores for each subgroup and analyzed. Total stress was scored as: 0-8, low stress 9-17, medium stress and 18-26: high stress.

Validity & Reliability of the tools:

The study tool was submitted to a panel of three experts in the field of Pediatric Nursing, Community Health Nursing and Psychiatric Nursing to test the content validity. Modifications were carried out according to the panel's judgment on clarity of sentences and the appropriateness of the content. Reliability was estimated by Alpha Cronbach's test for the Barf scale has good reliability ($r = 0.819$) and $r=0.76$ for Visual Analogue Scale.

Pilot study:

A 10% of the total sample (six children) who met the criteria of selection was included in the pilot study to assess the feasibility and the clarity of the tools and determine the needed time to collect the necessary data. Based on its result, little changes were done. The sample included in the pilot study was excluded from the study sample

Procedure:

To collect the data, the researcher went to South Egypt Cancer Institute - Assiut University in Egypt, pediatric outpatient clinic with the permit from manager of hospital, head of pediatric department and head of nursing to study the samples.

Select 60 children to enter the study participated in the study with non-probability sampling method and according to the goals.

After explaining the aim of the study to the children and their parents getting their permission, the first child was chosen by tossing a coin, then the other ones were placed in two groups as the infusionarium therapy group (N=30) and the control group (N=30) with routine care in traditional room for chemotherapy infusion.

Before beginning in the study, chemotherapy room (5 × 5 meters) painted by bright colors as pink, yellow, and green with fixed two 48 inches LCD screen with video device content of 20 video games suitable to children's age for study group.

The same room size (5 × 5 meters) for chemotherapy infusion was painted by white color as other hospital rooms for control group.

The children's demographic information was given by their families or taken from their files and then stress questionnaire was filled. The style on how to play the videos and games on LCD screen was explained to the children and their parents, then the LCD screen was played for children in the experiment group from starting the visit and before chemotherapy infusion starting and during infusion assess nausea and vomiting severity VAS for 3-9-year-old children or Barf scale for 9-12-year-old children. Researcher was explaining it has six faces depicting the levels of nausea. Rating scale was being four used to evaluate vomiting severity from starting of chemotherapy to two hours after ending.

The stress questionnaire was complete for children in the study group before and during infusion of chemotherapy therapy. The questionnaire was also complete and registered for children in the control group before and one hour after infusion of chemotherapy therapy starting. These actions were performed between 9 A.M and 11 P.M because it was after the doctors' visit, so quiet and peaceful, and with no disturbance.

Statistical analysis

Data entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Descriptive statistics were represented by frequency tables; Chi-square test was used to investigate the homogeneity of qualitative variables of the two groups and to compare between the groups in terms of stress level. T-test was performed to compare the mean and standard deviation concerning, nausea and vomiting occurrence data. In all tests, P < 0.05 was considered statistically significant.

6. RESULTS

Table (1): Socio-demographic characteristics of the studied subjects

Variables	Study (n= 30)		Control(n= 30)		X ²	P-value
	No.	%	No.	%		
Age: (years)						
3 – 6	21	70.0	16	53.3	1.76	0.184
7 - 12	9	30.0	14	46.7		
Sex:						
Male	18	60.0	20	66.7	0.29	0.592
Female	12	40.0	10	33.3		
Diagnoses						
Leukemia	10	33.3	7	23.3	0.74	0.390
Lymphomas	4	13.3	6	20.0	0.48	0.488
Brain tumor	8	26.7	10	33.3	0.32	0.573
Sarcomas	8	26.7	7	23.3	0.09	0.766

Table (1):- Shows the distribution of the studied subjects about socio-demographic characteristics. It shows that; the highest percentage (70%) of children of study group aged between 3-6 years, and about two thirds of both groups were males (60.0%, 66.7% respectively), also one third (33.3%) of study group had leukemia as compared to one third (33.3%) of control group had cancer in the brain.

Table (2): Frequency of vomiting during and 2 hours after chemotherapy

Vomiting frequency (times)	Group (Mean ± SD)		P-value
	Infusionarium(n= 30)	Control (n= 30)	
During chemotherapy	0.17± 0.7	0.34±1.1	0.411
After chemotherapy	0.22±1.0	0.60±1.2	0.013*
Total	0.20±0.88	0.51±1.0	0.014*

Table (2): Shows the frequency of vomiting during and 2 hours after chemotherapy. The findings showed no significant differences in the mean ± SD of vomiting during chemotherapy while significant differences found after chemotherapy between the two groups.

Table (3): Indices of nausea during and 2 hours after chemotherapy

		Group (Mean ± SD)		P-value
		Infusionarium group(n= 30)	Control group(n= 30)	
During chemotherapy	Frequency (times)	0.06± 0.24	0.14± 0.4	0.235
	Duration (min)	0.10± 0.6	0.5± 1.9	0.223
	Severity (point)	4.6± 18.9	10.4± 27.2	0.241
After chemotherapy	Frequency (times)	0.20± 0.5	1.68± 0.71	0.001*
	Duration (min)	0.73± 2.5	1.9± 3.6	0.002*
	Severity (point)	7.64± 19.7	35.8± 39.0	0.002*

Table (3): Shows the indices of nausea during and 2 hours after chemotherapy. The results showed no significant differences in the levels of nausea during chemotherapy between the two groups, while statistical significant differences was found between frequency, duration and severity of nausea 2hrs post-chemotherapy between two groups ($P = 0.001, 0.002, 0.002$) respectively.

Table 4: The comparison of stress levels during chemotherapy infusion in both the study and control groups

Stress level	Infusionarium (n=30)		Control(n=30)		P-value
	No.	%	No.	%	
Low	16	53.3	8	26.6	0.035*
Medium	8	26.7	11	36.7	0.405
High	6	20	11	36.7	0.152

Table (4): Shows the comparison of stress levels during chemotherapy infusion in both the study and control groups. Significant differences ($P= 0.035$) was found among the low level of stress during chemotherapy between the two groups, while no statistical significant differences was found among medium and high stress level during chemotherapy between two groups ($P = 0.405, 0.152$) respectively.

Table 5: Distribution of Mean ± SD and Median of stress levels during chemotherapy infusion in both the study and control groups

Stress level	Infusionarium (n=30)	Control (n=30)	P-value
Mean ± SD	10.57 ± 7.16	14.07 ± 6.16	0.036*
Median (Range)	8.0 (1.0 – 25.0)	13.5 (4.0 – 25.0)	

Table (5): Shows the mean ± SD and median of stress levels during chemotherapy infusion in both study and control groups. Significant differences ($P= 0.036$) was found among mean ± SD and median of stress levels during chemotherapy infusion in both study and control groups.

7. DISCUSSION

According to the findings of this study, approximately all indices of nausea and vomiting significantly reduced 2hrs post-chemotherapy by infusionarium and exhibited it is as a useful technique for control of CINV in children, with routine cancer treatment. But even though infusionarium reduced nausea and vomiting during chemotherapy (**Hossen, 2018**).

Studies illustration that acute CINV happens 1-2 hours after chemotherapy by the first 24 hours and delayed CINV happens 24-72 hours after chemotherapy. In our study, during chemotherapy, children had no nausea or vomiting, except those who had anticipatory type, because the consequence of chemotherapeutic drugs did not initiate and the effect of infusionarium was not significant during chemotherapy (**Sepúlveda et al., 2013**).

The vital point of this study was evaluating all the indices of nausea and vomiting, containing frequency, duration and severity of nausea and vomiting, while other results such as that of **Najafi et al (2012)** have only studied the nausea index and not the other indices of nausea and vomiting. The results of **Najafi et al. and Dune et al. (2009)** indicated a significant statistical correlation between the severity of nausea and video showing. These studies also presented that infusionarium therapy is an important method to diminish the CINV. But it is in contrast to the results of **Wolf et al., 2010** who found combined video games to decrease the symptoms of children with cancer, such as nausea, but that was not significant. It may be a result of the small sample size (video games = 16 and usual care = 7) in their study, and if the study had been done in a larger sample size, the effect of video games might have been significant.

Billhult et al., (2016) they described that video is useful for symptom management including nausea in children with cancer.

Bradt et al., (2014) they also presented that stress and pain are two significant factors that rise CINV and that infusionarium decreases stress and pain in young patients, so infusionarium therapy can also help to improve CINV by reducing stress and pain and enhancing psychological and physiological well-being.

In addition, infusionarium has a psychological impact on children. Since stress and also the mental experiences of the children may have negative effects on their treatment. Using non-medicinal methods is increasing to reduce and kill pain and anxiety out of which infusionarium therapy is an effective method so, it can be effective in improving nausea and vomiting center. But additional researches need to examine the real mechanism of infusionarium therapy on nausea and vomiting (**Greer et al., 2017**).

The fear of the side effects after chemotherapy in cancerous children leads to stress and anxiety that increases the disease pain, so the in outpatients sitting in infusionarium room can make them calm and relaxed and kills the pain (**Andersen et al., 2016**).

Significant differences ($P= 0.035$) was found among the low level of stress during chemotherapy between the two groups, while no statistical significant differences was found among medium and high stress level during chemotherapy between two groups ($P = 0.405, 0.152$) respectively.

In our study, there was significant statistical difference founds among low level of stress during chemotherapy between experimental and control groups. But no difference among medium and high stress level during chemotherapy between two groups.

In the current study, there were more than half of infusionarium group children have low stress level compared to 26.6% of control group children at the same level. There were 36.7% of the control group of children have high stress level while only 20% of infusionarium group children have also high stress level during chemotherapy, which shows the positive and efficient effects of infusionarium in reducing the stress during chemotherapy of the children.

Corner and Baily (2012) they did a research on the effect of play therapy on postoperative pain intensity in children under spinal anesthesia. Findings of the study showed that showing of play therapy during surgery with spinal anesthesia can reduce postoperative pain.

Yousefi (2015) who observe that the effects of cartoon films on the pain level in chronic cancer and suggested that there is a meaningful relationship between the pain level and the number of pain killers before and after cartoon films.

O'Callaghan et al. (2014) they conducted that a qualitative study on the relationship between music therapy and the children suffering from cancer in the Cancer Center of Peter McCallum in Melbourne, Australia. They found out that music can help cancer and it can make children calm, lower stress, promote care relationships, self-care and make them hopeful.

Stanczyk (2011) performed a research on video games in supportive care of cancer in Poland. Some aspects of video games functions in supportive care of cancer are shown in this study and video games can be a part of supplementary medicine in cancer to lower the related stress, pain and raise life quality.

Zengin et al. (2013) they assess the role of music on the pain and anxiety levels of the children under surgery in Turkey. The results recommended that music significantly reduced the stress hormone level, pains and anxiety levels.

The results of the study by **Mohamed et al. (2017)** presented that infusionarium has a significant effect on the level of anxiety, pain, vomit and vital signs of the children under surgery in Mansoura University Children's Hospital. Also, there was a meaningful difference between the sample and non-sample cases after infusionarium in decreasing pain, anxiety, vital signs of children under surgery.

The study results by **Shaban et al. (2015)** about the non-medicinal methods of video games influencing the pain level of cancerous patients suggested that a meaningful difference was seen in the pain level of the patients before and after video games ($P=0.001$). Also there was a significant difference in video games groups and music therapy groups which means pain has dropped a lot more in video games group than that of the music therapy ($P=0.016$).

Generally, regarding the infusionarium effects the results stated are consistent with the findings of the present research and all of them represent the positive effects of infusionarium therapy.

8. CONCLUSION

Infusionarium is an efficient medium for children suffering from cancer to have less incidence of physical complication of chemotherapy as nausea and vomiting and better feelings with low level of stress and cope with a cancerous life and adapt themselves to this life physically and mentally.

9. RECOMMENDATION

The results of the current study could be a guideline for nurses, who assist them to, trusting on their abilities and knowledge, as well as interactive them to the parents, have a useful contribution in reducing the children sufferings. It is suggested that further studies should examine the short-term and long-term effects of infusionarium on nausea and vomiting indices.

It is recommended to conduct progressive and permanent studies on infusionarium in specific alternatives since infusionarium has better effects on decreasing stress before and after chemotherapy in children and also the health professionals get familiar with infusionarium.

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