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Developing clinical protocol for nursing practice: Improving care of children with cancer towards implementing stem cell transplantation therapy

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Abstract
Back ground: Stem cell transplantation has generally painstaking as a curative management and also is a lifesaving technique for children with a many of malignant and non- malignant diseases.
So the aim of this study: was to develop clinical protocol for nursing practice for improving care of children with cancer through: 1- Assess nurses' knowledge and practices towards implementing stem cell transplantation therapy. 2- Design, implement and evaluate the effect of clinical protocol regarding to care of children with cancer.
Setting: This study accompanied at the in-patient and outpatient departments in Oncology department affiliated to South Egypt Cancer Institute, Assiut University.
The subject: of this study was all nurses (50) worked at the previously mentioned settings who were care giver for children with cancer.
Tools: Two tools were used (pre, post and follow up format), 1st tool; an interviewing questionnaire sheet for the nurses who give care for children with cancer. It comprised from two parts; personal characteristics of the studied nurses and nurses' knowledge towards implementing stem cell transplantation therapy. 2nd tool; observational checklist includes actual practice regarding to care of children with cancer during implementing transplantation.
Results: There were statistically significant differences regarding nurses' knowledge and practices about stem cell transplantation before, after and follow up protocol intervention.
Conclusion: Nurses' knowledge and practice toward children through implementing stem cell transplantation improved significantly post and at follow up implementation of nursing protocol.
The study recommended that: periodically educational training programs for nurses to help them to improve their practice for management of children with cancer in the pediatric oncology units to estrange and reduce the complications of cancer.

Keywords: Clinical protocol, nursing practice, cancer, stem cell transplantation, children

Introduction
A stem cell transplant (likewise called bone marrow transplant) is the imbuement of healthy stem cells into the body to stir new bone marrow development. Stem cells are fundamental to an individual's capacity to battle infection. Stem cell transplants are cultivated on children whose stem cells have been harmed by disease or obtrusive medicines for malignancy, for example, chemotherapy as well as radiation therapy [1].
A stem cell can ordinarily be characterized as clonal, self- renovating substance that is multipotent and therefore can create a few separated cell types. As such, stem cell is a cell that delivers an indistinguishable copy of it self-on many occasions accurately when it divides. This same stem cell can separate or turn out to be more than one explicit cell type. The capacity for "self - restoration" licenses for a potential continuous source of cells. The capacity to deliver offspring cells that can separate takes into consideration more tissues to get new cells when dead cells need to be supplanted or when harm tissues should be repaired. These two wide attributes of all stem cells, self-reestablishment and separation, give the potential capacity to utilize these foundational microorganisms in a wide range of therapeutic treatments [2].
There are various kinds of stem cells are analyzed. Stem cells are undifferentiated cells with the capacity to separation and offer ascent to indistinguishable and undistinguishable cells [(3)], nonetheless, progressively explicit attributes that characterize every particular stem cell type self-evident. The three general classifications of stem cells are embryonic, umbilical cord blood, and adult stem cells. Stem cell transplantation a lifesaving technique for various malignant and non-malignant life threatening diseases. In excess of 40,000 stem

cell ransplants are being performed every year in the world [4]. Stem cells, which have been utilized for a while in the treatment of leukemia and different kinds of malignancy have as of late begun to be utilized in medicine development, and this advancement offer trust in the treatment of diabetes, cardiovascular and neuro-generative disease however the applications are still unproven [5].

Stem cells therapy is a new method in Medical Science and it another strategy in Medical Science and it is the most cutting edge innovation available universally to repair the body's debilitating system, a large portion of the patients and their family members however shockingly they are oblivious about this clinical element [6].

The nursing protocol is a strategy for teaching nurses and designed for the independent education as an endeavor to keep away from any strains for procured new data whenever. In addition it positively affects the nurses' knowledge and practice and improved the nature of nursing care given to the children with stem cell transplantation [7].

Improving and keep up quality patient care through the improvement and usage of clinical protocols and utilization of evidence-based clinical protocols is a basic truth in health care framework. Nurses are consistently engaged with patient's instruction, evaluation and treatment. The utilization of clinical of clinical protocols has benefits for physicians, nurses, and patients. Since every protocol contains a thorough, cutting-edge audit of the disease procedure and gives the method of reasoning to every therapeutic choice [8].

Significance of the study

It is progressively significant that stem cell therapies be evaluated in equipped offices and in vision of the neglected medical needs that could be given by such medications that the work be quickened. A stem cell is a cell that can turn into an appropriate developing condition which has the ability duplicate, and can create cell types that proceed to separate and restore itself or guarantee own population and can reestablish tissue with functional damage [9]. It was seen from the clinical experience of the specialists that nurses had absence of information and work on with respect to mind of children towards implementing stem cell transplantation therapy. The wide-running necessities of children with malignancy and their families are best met through the planned conveyance of complete consideration by a multidisciplinary team of healthcare professionals**.** In the interim, the nurse is the foundation of these healthcare professionals, so it is critical to structure and actualize a clinical protocol for nurses to improve their knowledge and practice about care of children with cancer.

Aim of the Study

This study aimed to develop and implement clinical nursing protocol for care of children with cancer through:

1. Assess nurses' knowledge and practices regarding to care of children towards implementing stem cell transplantation therapy.
2. Design, implement and evaluate the effect of clinical nursing protocol.

Research hypothesis

The development and implementation of clinical nursing protocol for nursing practice will improve the care of children with cancer towards implementing stem cell transplantation therapy.

Subjects and Method

Research design

A quasi- experimental research design.

Settings

This study was conducted in South Egypt Cancer Institute at Assiut University Hospital.

Subjects

All nurses (50) from above mentioned setting who are providing direct care for child patients undergoing bone marrow transplantation.

Tools of data collection

Two tools were used by the researchers to obtain the necessary data

1) A Structured interview Questionnaire Sheet: It was designed by the researchers in simple Arabic language after reviewing the related literatures. It comprised from two parts as following:

Part I: Characteristics of the studied nurses that include; (age, level of education, current position, years of experience and attendance of previous training programs related to stem cell transplantation therapy).

Part II: Nurses' Knowledge Assessment Sheet: It was developed by the researchers after reviewing of the related literatures [16] to assess nurses' knowledge about stem cell therapy in relation to definition of stem cells, sources of information about stem cells, classification, sources of stem cell, application of stem cells in pediatric, and importance of stem cell

Scoring system: According to the responses obtained from the studied nurses, a scoring system was followed to assess the nurses' knowledge; each question scored two for complete answer, scored one for incomplete answer and scored zero for incorrect answer. The total score of the questionnaire equals sixteen grads.

Nurses' knowledge scores were categorized into; good knowledge for nurses who scored 75 percentage and more, average knowledge for nurses who scored 50 to < 75percentage and poor knowledge for nurses scored less than 50percentage of total scores.

2) Observational Checklists for nurse's practice

This tool was developed by the researchers after reviewing relevant literatures [10,11,12,13,14,15] to assess nursing practice regarding to care of children with stem cell transplantation therapy such as measuring vital signs; temperature, pulse, respiration & blood pressure, measuring weight, collecting of blood sample, intake and output chart, hand washing and mouth care.

Scoring system: Each procedure scored 5 to 10 according to weighting of each procedure that make a total score of 100 grades (equal 100percentage). The scoring systems were classified into competent when nurses' practice scored 85percentage and more and incompetent when nurses' practice scored less than (85 percentage) of total scores.

3) Clinical nursing protocol construction: it was designed by the researchers based on related literature.
Protocols are generally organized into three sections: an overview of the relevant disease process, a review of current evidence-based clinical practice, and a step-by-step management plan. The content was prepared according to nurses' educational needs regarding to improve their knowledge and practices regarding to care of children with cancer towards implementing stem cell transplantation therapy.

Preparatory phase: A review of the past and current related literatures covering various aspects of stem cell transplantation utilizing accessible books, periodical articles, and magazines to get to acquainted with the research problem to build up the study tools.

Pilot study: Pilot study was done on 10 percentage of total subject size of nurses (five) to test the applicability and assess to evaluate the content validity of the study tools. Results of the pilot study helped to make modifications on the tools; some items of questionnaire were modified and unnecessary questions were omitted. It takes around one month from the finish of January as far as possible of February 2018. The nurses in the pilot study were avoided from the study sample.

Validity and reliability: The developed tools were assessed by a panel of five experts from Medical and Nursing professors at faculty of Medicine and Nursing (Pediatric Oncology Department) to affirm its content and face validity before its utalization. The required modifications were done accordingly and then test-retest reliability was applied. Testing reliability of the study tools was done by Crombach alpha, the result was 0.80.

Field work: The actual field work has expended six months begun the first of March 2018 up to the end of August 2018 for data collection and three months later for follow up started from end of November to the January of 2019, through the accompanying stages:

The first phase: (Pre- protocol of care for data collection); this phase started with the nurses' interview and the researchers introduce themselves, orient, and explain the purpose of this study to gain nurses cooperation & to assure the nurses about the anonymity of their answers and that the information will be used for scientific research only and was be strictly confidential.
The data was collected by utilizing the study tools, where nurses were individually interviewed. The researchers assess the nurses' practice through observation checklists while the nurses given care of children with cancer through using stem cell transplantation therapy. The researchers were available three days per week from 8 am to 2 pm until the required information were gathered.

The second phase: preparation of clinical nursing protocol: The researchers arranged the content of the clinical nursing protocol by Arabic language dependent on related literature and spread the related theoretical parts of stem cell transplantation. It included knowledge about definition of stem cells, sources of information about stem cells, stem cell classification, sources of stem cell, application of stem cells in pediatric, and importance of stem cell. Meanwhile, the protocol also includes the practical part. It included measuring vital signs (temperature, pulse, respiration & blood pressure), measuring weight, gathering of blood sample, intake and output chart, hand washing and mouth care.
Developing the clinical nursing protocol contents was then tailed by picking the reasonable teaching methods and appropriate media. During the implementation of the protocol the researchers utilized the following assistive aids: A booklet was created by the researchers including illustrative pictures; it was used in the educational sessions CD (Compact Disc) likewise, was appropriated to the nurses toward the end of the nursing protocol implementation. It was given to nurses with handout for amendment of knowledge about stem cell transplantation therapy.
The protocol intervention devoured around about four months, three days out of every week spent in leading the training protocol. Consequently, the subject content has been sequenced through 16 sessions the subject content has been sequenced through 16 sessions (6 sessions for theory and 10 sessions for practice). The time at each session ranged from 45 to 60 minutes containing periods of discussion. At the beginning of first session, an introduction about the protocol was done. Each session started with the summary feedback about the preceding session, simple words and Arabic language were used to suit the nurses' level of understanding. Different methods of teaching were used as lectures and demonstration and re- demonstration. Suitable teaching aids were arranged and utalized during the protocol implementation such as real equipment, posters and pictures.
Each nurse was observed and evaluated utilizing the observational checklist which filled by the researchers during providing care for the child with stem cell transplantation post protocol intervention. Time expended for assessing each technique taken almost ten to twenty minutes. In addition, the nurses were interviewed to assess their knowledge using the questionnaire format; all questions were designated in the form of close ended questions, and nurses took around 30 to 45 minutes to fill it.

The third phase (follow up test): follow up protocol of care leading following 3 months from the end of November to the end of January 2019, using the previous questionnaire and observational checklist.

The protocol evaluation: program appraisal was done by comparing the nurses' knowledge and practices through pre, post and follow up of the protocol intervention using questionnaire format sheet and observation checklists.

Ethical considerations: Written informed consent was gained from studied nurses by the researcher. Anonymity and confidentiality of the study subject had been secure. They were be conversant that all the collected data were be used for research determination only. They had the right to pull back from the study whenever unreservedly.

Administrative design: An official permission obtained from the Dean Faculty of Nursing, Assiut University, medical and nursing directors and head of each department in study settings so as to direct the study after clear description about the aim of the study and its advantages.

Statistical design

The gathered data were composed, updated, coded, classified and analyzed utalizing the number and percentage distribution. Data entry were done using Microsoft Excel 2003 computer software package, while statistical analysis were done using SPSS 16.0 statistical software package. Data was present using descriptive statistics in the form of frequencies and percentages for qualitative variables, means and standard deviations for quantitative variables. P value was used to estimate the statistical significance difference between the study variables (p-value < 0.05 will be accepted as significance).

Results

Table 1: Number and percentage distribution of the studied nurses according to their characteristics (n=50).

Item	(N0= 50)	%
Age in years		
< 20	2	4.0
20-	17	34.0
30 -	15	30.0
≥ 40	16	32.0
Range Mean ± SD	22.0-57.0 35.3±8.7	
Nursing qualification		
Diploma in nursing	37	74.0
Technical institute diploma	4	8.0
Bachelor	9	18.0
Job position		
Staff nurse	30	60.0
Supervisor nurse	20	40.0
Years of experience		
< 5 years	2	4.0
5< 15years	24	48.0
15< 25years	19	38.0
≥ 25 years	5	10.0
Mean ± SD	15.1 ± 7.6	
Attending training courses about stem cell transplantation		
Yes	10	20.0
No	40	80.0

Table (1): As regards characteristics of the studied nurses, this table finds that the mean age of nurses was 35.3 ± 8.7 years. As regard nurses' qualification, it was found that less half of them (48.0%) had diploma of nursing, while a few of them (8.0%) had bachelor degree. In relation to nurses' job it was observed that, 60.0% and 40.0% of them were staff nurse and supervisor respectively. It is clear from this table that, the mean years of experience was15.1±7.6 years and 80% of them not attending program courses related to stem cell transplantation.

Table 2: Number and percentage distribution of nurses' knowledge regarding to stem cell transplantation pre/post and at follow up implementation of nursing protocol (n=50).

Knowledge of stem cells	Pre		Post		Follow up		X^2 (p-value) Pre-post	X^2 (p-value) Post- Follow up
	No.	%	No.	%	No.	%		
Definition of stem cells								
Correct	12	24.0	41	82.0	33	66.0	33.76 (0.000)*	3.32 0.068
Incorrect	0	0.0	0	0.0	0	0.0		
Don't know	38	76.0	9	18.0	17	34.0		
Sources of information about stem cells							41.22 (0.000)*	1.62 0.202
Correct	11	22.0	43	86.0	38	76.0		
Incorrect	0	0.0	0	0.0	0	0.0		
Don't know	39	78.0	7	14.0	12	24.0		
Types of stem cell							55.15 (0.000)*	13.69 (0.001)*
Correct	0	0.0	35	70.0	20	40.0		
Incorrect	14	28.0	7	14.0	24	48.0		
Don't know	36	72.0	8	16.0	6	12.0		
Sources of stem cell collection							29.37 (0.000)*	1.26 0.260
Correct	12	24.0	39	78.0	34	68.0		
Incorrect	37	74.0	11	22.0	16	32.0		
Don't know	1	2.0	0	0.0	0	0.0		
Importance of stem cell	0	0.0	33	66.0	24	48.0	52.71 (0.000)*	4.80 0.091
Correct	34	68.0	16	32.0	26	52.0		
Incorrect								
Don't know	16	32.0	1	2.0	0	0.0		

Table (2): Regarding to nurses' knowledge about stem cell transplantation therapy, this table clarifies that more than two thirds (82.0%) of nurses scored good knowledge post implementation of nursing protocol, compared to less than one quarter (24.0%) before intervention. As regards definition, sources of information about stem cells and Stem cell classification there is statistical significant difference between pre and post implementation of nursing protocol (P= 0.000). Meanwhile, the nurses' level of knowledge showed some decline at follow up phase. There is statistical significant difference between post and follow up of nursing protocol intervention regarding to nurses' knowledge about stem cell classification ($P < 0.001$).

It is clear from this table that after implementation of nursing protocol 78.0% of studied nurses had good score in their knowledge regarding to sources of stem cell collection compared to 24.0% before protocol intervention. Meanwhile, 66.0% of studied nurses had good score in their knowledge regarding to importance of stem cell post implementation of nursing protocol respectively, compared to none of nurses had good score before protocol intervention. There is highly statistical significant difference before and after implementation of nursing protocol (p= 0.000). While, there is no statistical significant difference was found between post and follow up of protocol intervention.

Table 3: Number and percentage distribution of nurses' practice pre/post and at follow up implementation of nursing protocol (no=50).

Items	Pre		Post		Follow up		X^2 (p-value) Pre-post	X^2 (p-value) Post- Follow up
	No.	%	No.	%	No.	%		
Wear masks and sterile gloves								
Competent	7	14.0	32	64.0	27	54.0	26.27	1.03
Incompetent	43	86.0	18	36.0	23	46.0	(0.000)*	0.309
Collecting of blood sample								
Competent	15	30.0	40	80.0	28	56.0	25.25	6.61
Incompetent	35	70.0	10	20.0	22	44.0	(0.001)*	(<0.010)*
Intake and output chart								
Competent	7	14.0	32	64.0	27	54.0	26.27	1.03
Incompetent	43	86.0	18	36.0	23	46.0	(0.000)*	0.309
Hand washing								
Competent	15	30.0	40	80.0	28	56.0	25.25	6.61
Incompetent	35	70.0	10	20.0	22	44.0	(0.001)*	(<0.010)*
Oral hygiene								
Competent	11	22.0	36	72.0	45	90.0	25.09	5.26
Incompetent	39	78.0	14	28.0	5	10.0	(<0.001*)	(0.02*)

Table (3): This table clarifies that, before implementation of nursing protocol there is less than one quarter of studied nurses (14.0%) was scored competent in their practice regarding to wear masks and sterile gloves. Meanwhile, post protocol intervention nearly two thirds (64%) of nurses scored competent practice regarding to the previous item. There is highly statistical significant difference was found between pre and post protocol intervention (P<0.000). Meanwhile, there is no statistical significant difference between post and at follow up implementation of nursing protocol in previous item. However after implementation of nursing protocol the majority (80%) of studied nurses were competent in their practice regarding to collecting of blood sample and hand washing compared to less than half (30%) of nurses were competent in their practice before protocol intervention. There is statistical significant difference was found between pre and post implementation of nursing protocol (P<0.001). As well as at follow up phase nurses' practice in all areas showed statistical significant difference in taking blood sample, hand washing and oral hygiene (P<0.001, < 0.001 and < 0.001) respectively.

Table 4: Number and percentage distribution of nurses' practice of measuring vital signs for pre/post and at follow up implementation of nursing protocol (no=50)

Measuring vital signs	Pre		Post		Follow up		X^2 (p-value) Pre-post	X^2 (p-value) Post- Follow up
	No.	%	No.	%	No.	%		
Oral temperature							25.25 (0.000)*	3.17 0.075
Competent	15	30.0	40	80.0	32	64.0		
Incompetent	35	70.0	10	20.0	18	36.0		
Pulse							29.17 (<0.001*)	49.98 (<0.001*)
Competent	11	22.0	38	76.0	46`	92.0		
Incompetent	39	78.0	12	24.0	14	28.0		
Respiration							31.41 (0.000)*	4.76 0.029
Competent	10	20.0	38	76.0	46	92.0		
Incompetent	40	80.0	12	24.0	4	8.0		
Blood pressure							46.31 (<0.001*)	0.06 (0.80)
Competent	7	14.0	41	82.0	40	80.0		
Incompetent	43	86.0	9	18.0	10	20.0		

Table (4): Regarding to nurses' practice about measuring vital signs as oral temperature, pulse, respiration and blood pressure throughout implementation of nursing protocol.

This table indicates that pre protocol intervention low percentages of nurses' competent performance are notice in relation to all vital signs (14% to 30%). After protocol

intervention there is statistical significant improvement in all vital signs (P <0.001). Meanwhile, at follow up phase, there is only statistically significant difference between post and at follow up protocol intervention regarding to the pulse (P <0.001).

Table 5: Number and percentage distribution of nurses' total knowledge at pre, post and follow up phases of clinical nursing protocol intervention (n=50).

Item	Total knowledge					
	Pre(n=50)		Post(n=50)		Follow up(n=50)	
	No	%	No	%	No	%
Poor	49	98.0	7	14.0	13	26.0
Average	0	0.0	7	14.0	7	14.0
Good	1	2.0	36	72.0	30	60.0

Table (5):- Indicates that, the majority of studied nurses (98%) had poor level of knowledge related to their total knowledge about stem cell transplantation at the pre implementation of clinical nursing protocol. Meanwhile, nearly to three quarters (72%) of them had good level of knowledge at post protocol intervention and declined to 60%. at the follow up phase.

Table 6: Number and percentage distribution of nurses' total practice at pre, post and follow-up phases of clinical nursing protocol intervention (n=50).

Item	Total practice					
	Pre(n=50)		Post(n=50)		Follow up(n=50)	
	No	%	No	%	No	%
Competent	7	14.0	34	68.0	27	54.0
Incompetent	43	86.0	16	32.0	23	46.0

Table (6): Illustrates that, at pre implementation of nursing protocol 14% of studied nurses had competent of total practice regarding skills of stem cell transplantation. Meanwhile, competence increased to 68% at post protocol intervention, and competence of nurses declined to 54%, at follow up protocol intervention.

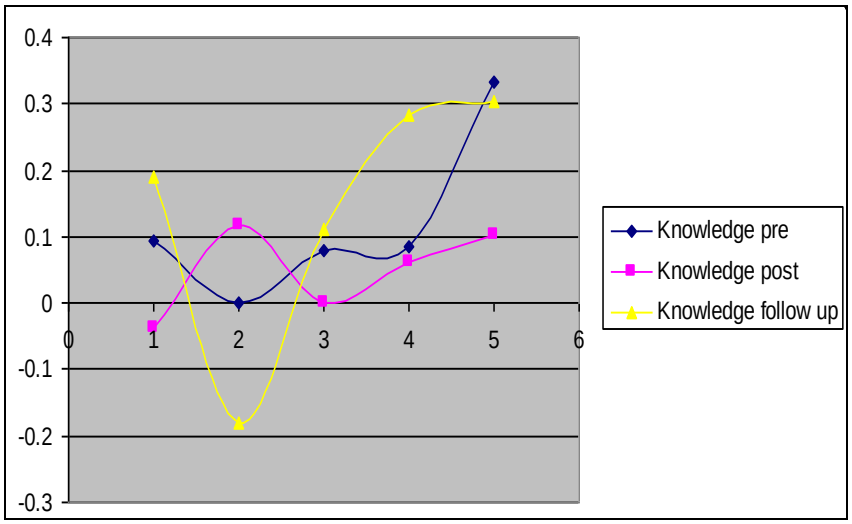

Fig 1: Correlation between characteristics of nurses and their total knowledge pre/post and at follow up implementation of clinical nursing protocol about stem cell transplantation.

Figure (1) Illustrates that, there was statistical significance correlation between total knowledge in pre implementation of nursing protocol in relation to training courses (p=.019). This figure also displayed that, there are no statistical significance correlations between total knowledge in post protocol intervention in relation to all socio-demographic data. Moreover, there are statistical significance correlation between total knowledge at follow up phase in relation to years of experience, and training courses (p=.047, and p=.032) respectively

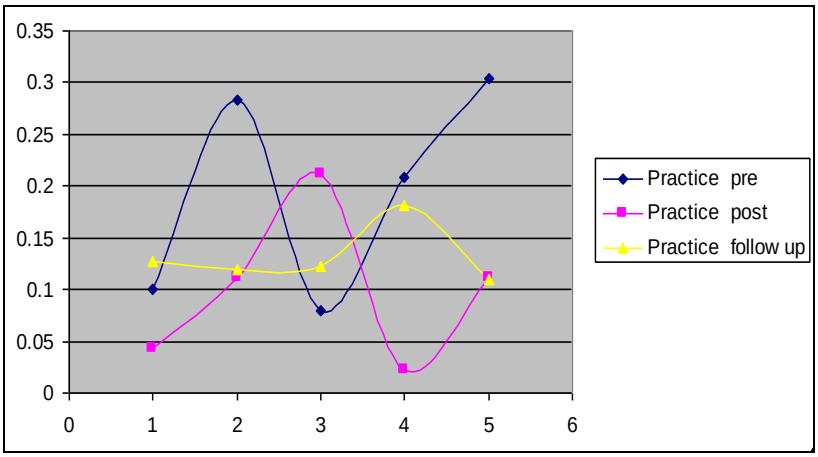

Fig 2: Correlation between characteristics of nurses and their total practice pre/post and at follow up implementation of clinical nursing protocol about stem cell transplantation (n=50).

Figure (2) Shows that there were statistical significance correlation between total practices in pre implementation of nursing protocol in relation to qualifications and training courses (p=.047, and p=.032) respectively. This figure also stated that, there is no statistical significance correlations between total practices score in post and at follow up protocol intervention in relation to all personal data.

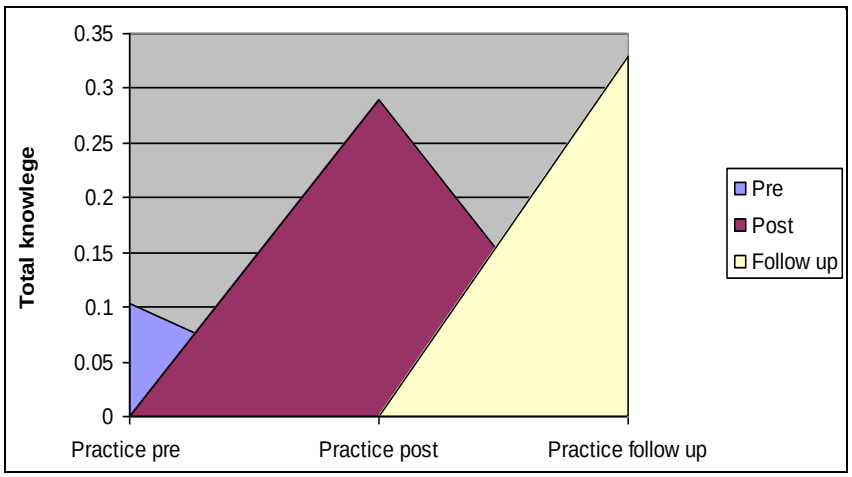

Fig 3: Correlation between socio-demographic data of nurses and their total knowledge and total practice of stem cell transplantation in relation to pre/post, and at follow up implementation of nursing protocol among the studied nurses (n=50).

Figure (3): Reveals that there were a statistical significance correlation between total practices in post implementation of nursing protocol and total knowledge in the same phase, moreover, there is a statistical significance correlation between total practices at follow up protocol intervention and total knowledge in the same phase (p=.042, and p=.019) respectively. This figure also stated that, there are no statistical significance correlations between total practice and total knowledge in pre protocol intervention.

Discussion

Stem cells have incredible guarantee to help us appreciate and deal with a scope of maladies, wounds and other wellbeing related conditions. Their likely is clear in the utilization of blood stem cells to treat diseases of the blood, a treatment that has secured the lives of thousands of children with leukemia; and can be found in the use of foundational microorganisms for tissue unions to get diseases or injuries the bone, skin and surface of the eye. Important clinical trials containing stem cells are in progress for some, different conditions and scientists keep on investigating new ways utilizing stem cells in medicine [17, 18].

With respect to nurses' knowledge about stem cell transplantation therapy, the study results uncovered that a few of studied nurses had good knowledge at the pre implementation of clinical nursing protocol contrast to more than two thirds at post protocol intervention and slightly decreased at the follow up phase. These differences are statistically significant. This outcome can be defended from the researchers to the way that stem cells transplantation are new best in class pattern, and absence of constant education and planning before work or preparing worried to mind of such group of patient, notwithstanding absence of their inspiration to refreshing their knowledge. In addition, nursing educational plans stayed inadequate in this issue which influences level of nurses' knowledge. This outcome was concurred with El- Sayed *et al.*, (2018) [19], who expressed that around three-quarters of the participants had sufficient knowledge subsequent to getting an instructive program and there was a large contrast between the degree of information in the pre and post instructive program**.**

Then again, this outcome was concurred with Khalil and Sharshor (2016) [20] that surveyed the nurses' information about stem cells in Tanta, Egypt, they revealed that nurses' knowledge about stem cells is inadequate in more than half of participants, so they need educational program to improve it. In addition to Mary, (2015) [21], found that the nurses had inadequate knowledge regarding placental stem cells. Likewise, Mohamed and Sayed (2015) [22] expressed that nurses in their study had poor knowledge about stem cells pre educational program, and showed statistical significance improvement in knowledge post-test and 3 months after the intervention.

Likewise, this outcome was bolstered by Leng etal., (2016) [23], who revealed that the nurses had a moderate level of knowledge. Notwithstanding Keng (2016) [24] referenced that nurses' knowledge toward bone marrow and stem cells is moderate and they prescribed the requirement for in-administration instructive programs related to bone marrow and stem cells to develop nurses' knowledge and practice so as to fit this contemporary pattern in health care.

The result of the present study explained that, at pre implementation of clinical nursing protocol a majority of studied nurses had incompetent level of performance in regard to care of children with stem cell transplantation therapy contrasted with more than two third of them had competent level of performance at post protocol intervention, and declined to more than half of them at follow up protocol intervention phase. The lack of nurses' practice regarding to stem cells transplantation may might be because recently exposure to stem cell technology in the clinical environment as it was a later development. Moreover the nurses come up short on the effectiveness of refreshing their training subsequent to being settled in the clinical condition for a more extended time. These findings were in accordance with Wood (2011) [25] who detailed that in his study about assessment of nurses' patterns of practice in the field of stem cell transplantation, assume a key job in surveying, observing and supporting patients in their pharmaceutical treatment, so it is emphatically prescribed that nurses need essential preparing and persistent

instruction to advance this issues**.**

On the other hand Kirsch *et al*., (2014) [26] who detailed that educational interventions are viewed as best for stem cell transplantation nurses regarding for training patients during their inpatient stay and providing patient/family teaching guidelines. In addition to Cancer and Hematology Centre (2017) [27] referebnced that the nurses in regards to for preparing patients during their inpatient remain and giving persistent/family educating rules and manage the care of the donor during marrow transplantation. On the other hand, after three months from the educational program, students' knowledge and practice was slightly declining due to absence of practice or forgetting. This burdened that the educational program ought to be rehashed after a certain interval to increase their knowledge and maintain their achievement. In this way, follow up training is generally basic to persistently overhaul the understudies' information and practice. This could be through outfitting them with booklet and pamphlets boosting their insight and practices routinely.

The present study indicated that there was highly statistical significant correlation between total nurses' knowledge and their practice. These results were in contract with Habib *et al*., (2017) [28], who revealed that there was a strong statistically significant differences positive correlation between the total knowledge score and the total practice score of the studied sample. Also, this finding is Incomparable to a study conducted by El-Sayed Shaban *et al*., (2019) [29], who refrenced that there was a statistically significant improvement in the total score practice and knowledge before, immediate and after the application of the educational program as (P = 0.00).

The result of the current study indicated that there was a positive correlation between nurses' knowledge and practice in connection to experience period in years and participation of past training programs about stem cell transplantation therapy. This could be clarified that the nurses acquired knowledge legitimately after training program about stem cell transplantation therapy. While the nurses experiencing their clinical work in the inpatient unit that provide them with a major assortment of knowledge and make them aware of updated knowledge. This result was in line with Abed El-Hay *et al*., (2018) [30] who reported that on surveying the knowledge of the studied sample's regarding stem cells, the finding of a statistically significant difference between the one to five years of experience group and all the other groups (p =0.003) were noted. While conversely Keng (2016) [24] referenced that outcomes from this survey indicated that there was no association between stem cell awareness with gender, nationality, race, religion or year of the respondents in medical school.

Conclusion

In the light of the existing study, it can be concluded that: Development and application of clinical nursing protocol had a positive effect on nurses' knowledge and practice on concerning care of children undergoing stem cell transplantation therapy. Also there were statistical significant positive correlations among knowledge and practice in relation to personal characteristic of nurses

Recommendations

Based on results of the present study, the following recommendations are suggested that.

1. Training and proceeding with education program for nurses through the protocol to help them to assist them with improving their knowledge and practices for management of children undergoing stem cell transplantation therapy.
2. Standards for nursing care of children undergoing stem cell transplantation therapy ought to be established that contain update knowledge and practice and dispersed all hospital.
3. Periodically revision of a protocol of care about childhood stem cell transplantation therapy, and update it to add what's going on to care cancer.
4. Further studies ought to be led to contemplate the impact of nursing protocol in every hospital.
5. Further research with large sample from nurses is recommended to refresh update information among them.

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