To Evaluate Effectiveness of an Educational Program on Nurses Knowledge about Nursing Management of Children Undergoing Bone Marrow Aspiration and Biopsy

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Abstract

Background: Examining the bone marrow is a process that, bone marrow samples are often collected with a needle from the sternum or posterior iliac crest of the hip bone. A greater understanding for bone marrow aspiration procedures and diagnostic tests helps oncology nurses to provide better patients care. Many complications are connected to bone marrow biopsy and aspiration (BMAB), the most common dangerous complications associated with BMAB are hemorrhage, infection, arteriovenous fistula, and trauma. Prevention of BMAB complications is important in nursing management. The study aims to assess nurse's Knowledge About Nursing Management for Children Undergoing Bone Marrow Aspiration and Biopsy Procedures.

Methods: Pretest-posttest quasi-experimental approach was used in this investigation. The sample included 25 individuals. A pilot study was carried out to determine the reliability of the questionnaire before it was given specialists for confirmation. questionnaire was composed of two parts, the first part was concerned with the socio-demographic characteristics, and the second part from three groups dealt with nurses' knowledge about blood diseases, Nurses' knowledge of biopsy and aspiration of the bone marrow and Nurses' knowledge of a biopsy and bone marrow aspiration and nursing care.

Results: The study revealed a considerable knowledge gap between the pre and post-interventional programs for nurses. The study group showed that nurses demonstrated a "fair" level of knowledge prior to the test (Mean= 1.45), while Knowledge level was "good" on the post-test. (Mean=1.95).

Compared with control group appeared nurses display "fair" knowledge during the pretest (mean=1.43), and posttest (mean=1.51).

Conclusions: An intervention training program was successful in enhancing nurses' knowledge of nursing Children's management undergoing bone marrow aspiration and biopsy procedures. The nurses' knowledge was increased after receiving training. about nursing management for Children undergoing bone marrow aspiration and biopsy procedures and not affected by time.

Recommendations: The study recommended apply educational and interventional programs for nursing in order to improve their knowledge regarding bone marrow aspiration and biopsy.

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Introduction

W Bone marrow is the soft, porous, and jelled tissue located inside the blank spaces of bones, the average weight of bone marrow is equal about 4% of all the body weight that equal 2.6 kg in 65 kg an adult weight (1).

Bone marrow is an important part of the lymphatic system, stem cells which lines in the bone marrow to produce new blood cells and stromal cells (2).

Bone marrow aspiration (BMA) is one of the procedures commonly used for diagnoses as well as treatments, the procedure was developed in the beginning of nineteenth century allowed doctors to diagnose marrow disorders. BMA has been widely used in regenerative therapeutic strategies

Although BMA has numerous diagnostic advantages, it is always associated with pain and stress (3).

Bone marrow aspiration and biopsies are performed primarily to enable cytological evaluation, but they can also be used for specialist investigations in immunophenotypic, cytogenetic, molecular genetics, and other fields. Frequently, a trephine biopsy is performed together with the same surgery (4).

The bone marrow aspiration procedure was done by puncture of the bone, in the sternum or the posterior iliac crest of the pelvic bones, with local anesthesia, and after extracting a few milliliters of blood from the marrow of the bone, in addition to identifying the lymphoblasts by morphology (by microscopy), the doctors will have attempted to identify the lymphoblasts by microscopic inspection of the medullar blood, which typically make up more than 20% of all the cells of the bone marrow. (5).

The diagnosis, staging, and therapy of patients with hematopoietic and nonhematopoietic illnesses all depend on the results of a bone marrow biopsy. It has been demonstrated that pathologists' capacity to appropriately histologically identify and diagnose a disease is influenced by the quality of the biopsy. Overall cellularity, information on the detection of localized lesions, marrow cellularity, tumor metastasis, and disease detection are all provided by biopsies (6).

Hematological and non-hematological illnesses can be diagnosed with the aid of a bone marrow aspiration. The diagnosis, staging, and follow-up of anemia, pancytopenia, lymphoproliferative diseases, lymphomas, and many other hematological abnormalities are among the indications for this treatment. Unknown pyrexia, granulomatous illnesses, metastatic malignancies, and a few inborn metabolic abnormalities are examples of non-hematological ailments. The use of bone marrow aspiration in more advanced and auxiliary procedures includes genetic and chromosomal research (7).

A specialized needle is introduced into the bone during a bone marrow aspiration procedure, and marrow is then suctioned out. When diverse blood cell types are compromised, BMA is necessary, especially when all three cell lines (white blood cells, red blood cells, and platelets) are impacted, which correlates to a decrease in bone marrow production. (8).

The bone marrow (BM) is the main hematopoietic location because it develops as the last blood-forming tissue during ontogenesis and after birth. It is a dynamic organ in terms of how it functions, and how well it maintains good hemostasis, fights infections, and gets enough oxygen (9).

Hematological problems in children range from fairly benign situations like acute leukemia, which needs immediate treatment, to quite malignant conditions like iron deficiency anemia (IDA) and megaloblastic anemia. (10).

Examining the bone marrow (BM) is a routine procedure in medicine. In the diagnosis of numerous hematological and non-hematological illnesses, it is a crucial investigation. In patients with unexplained abnormalities of any type of peripheral blood cell, this assessment is thought to be crucial. It has also developed into a crucial element in the post-treatment evaluation of patients who receive chemotherapy, bone marrow transplants, and other types of medical treatments. (11), concluded that the nurses' understanding of leukemia was lacking. Therefore, it is necessary to determine where there is a knowledge gap and to start training sessions to fill it. In this study, 30 Iraqi nurses were used to analyze how an education program affected their knowledge of nursing. (12).

Nursing workers who care for bone marrow transplantation patients should consistently practice good hand hygiene to prevent exposing patients to bacterial infections (13).

In order to act safely and competently at all times, they should be held to professional and ethical standards that compel them to retain current knowledge and skills in the field of bone marrow transplantation. (14).

Nurses that work in hematology/oncology, transplant, and cellular therapy (TCT) settings are essential to assessment, intervention delivery, and education along the HCT trajectory. The management of several intravenous (IV) drugs, parenteral nutrition, psychological variables, and labile patient stability throughout transplant are some of the reasons that contribute to the high patient acuity in TCT settings (15).

Bone marrow samples must be collected, patients must be supported throughout the procedure, and patients must be informed of the results. With this understanding, nurses may better support their patients during a stressful situation can help them better comprehend their condition. Staff nurses must be knowledgeable about the complications associated with this treatment, such as pain control, post-operative care, and psychological support for the patient and family. Greater comprehension of the procedure and the tests carried out aids in the patient's full education, which reduces worry, fosters comfort, and enhances perception and happiness with this method. (16).

Methodology: A purposive (Non-probability) sample of (25) nurses was selected. The researcher takes the program, the selection of nurses who work in blood diseases center especially who work in bone marrow aspiration and biopsy rooms in the Hematology Center at Babel Teaching Hospital for Women and Children and the Fever Unit at Marjan Medical City Hospital , with the applied pre-test The health interventional programs being delivered as classroom lectures for participants. Data collection is done by self-administrated questionnaire form and it was given for nurses to answer after taking their agreement from the period 18th February 2023 to 16 of March 2023.

Setting of the Study.

The current study is conducted in the Blood diseases in the Babel Teaching Hospital for Women and diets in Children and Marjan City Teaching Hospital Babylon Province

Sample of the study:

25 nurses were included in convenience (non-probability) sample, was selected. The researcher takes the knowledge and practice of the nurses then the nurses are exposed to the interventional program, the selection of nurses who work in blood diseases center especially who work in bone marrow aspiration and biopsy rooms.

Criteria Inclusion.

The selection criteria for the study samples are:

- The nurses who are work in bone marrow aspiration and biopsy rooms in blood diseases center.
- Nurses of all genders.
- Every nurse's degree of education.
- Agree to participants in the present study.

Criteria Exclusion.

The nurses who are don't work in bone marrow aspiration and biopsy rooms.

The nurses who have less than 1-year experience.

Instrument of the study:

The researcher has created an instrument for the aim of gathering data that has two sections and is intended to be used to assess the effectiveness of interventional programs:

Part I: The demographic information comprises information about nurses, such as gender, age, socioeconomic status, degree of education, working hours, environment, and years of experience.

Part II: This Part is Constructed to Assess of Nurses' knowledge consist of three domains.

A.   Nurses' knowledge about blood diseases (17) items.

B.   Nurses' knowledge of bone marrow aspiration and biopsy (24) items.

C.   Nurses' knowledge of bone marrow aspiration and biopsy and nursing care (20) items.

Design

The study selected quantitative research " a Quasi-experimental

design" to carry out in the Hematology Center at Babel Teaching Hospital for Women and Children and the Fever Unit at Marjan Medical City Hospital to assess the impact of a nursing education program for nurses' knowledge of Nursing Management for Children Undergoing Bone Marrow Aspiration and Biopsy Procedures, the study got underway on (the 25t of December 2022 to 16th of March 2023), with the applied pre-test.

Participants in the health interventional programs receive them through classroom lectures. After taking their self-administered questionnaire, nurses were given the opportunity to collect data. Therefore, the study design described in Table (1-1), from the period 18th February 2023 to 16 of March 2023.

Reliability of the study.

In the current study, the test-retest kind of reliability was identified; Giving a group of individuals the same test twice over a period of time allows for the measurement of this type of reliability. The results from Time 1 and Time 2 can then be compared to determine the test's stability over time.. The statistical package for social science program (IBM SPSS) version 26.0 was used to generate the Pearson Correlation Coefficient, which was then used to a sample of five randomly chosen participants to determine the test-retest reliability.

Table (1) Instrument Reliability Analysis (N = 5)

Scales	No. of Items	Pearson correlation	Evaluation of Test-retest
Knowledge	60	0.750	Accepted

The reliability analysis in this table shows accepted evaluation for knowledge scale (0.750), indicating that the test-retest and equivalence measurability of the questionnaires was satisfactory.

Data Collection

Before proceeding with the data collection process, the researcher makes arrangements to obtain study samples from The Hematology Center at Babel Teaching Hospital for Women and Children and the Diet Unit at Morgan Medical City Hospital to evaluate nurses' knowledge of nursing care for children receiving bone marrow transplants Aspiration and Biopsy Procedures. is done on 18th January 2023 to 30th January 2023, and was made by using Study tools the use of an interventional program. And a pre-test, post-test strategy was employed.

 data were collected by the following techniques:

1. Pre-test data collection (25) nurses from The Hematology Center at Babel Teaching Hospital for Women and Children and the Diet Unit at Morgan Medical City Hospital, is done on 18th January 2023 to 30th January. All participants were called to attend the same classroom to perform the pre-test.

2. Implementation the educational program by four lectures in 4 weeks at 6th February 2023 to 1th March2023, time for each lecture (40-50 minutes)from the hour 11:00 a.m. to 11:45 a.m. The teaching methods were: (classrooms, whiteboard, computer, data presentation slides, projection screen, CD, notebooks).

3. The post-test data collection process, for (25) nurses, is done on 5th 2023 to 16th March 2023.

Methods of Statistics:

The statistical package for social science program (IBM SPSS) version 26.0 was used to generate the Pearson Correlation Coefficient.

Results:

Table (1): Distribution of Nurses based on Socio-demographic Information

No.	Characteristics		Study group		Control group	
			f	%	f	%
1	**Gender**	Male	10	40	14	56
		Female	15	60	11	44
		Total	**25**	**100**	**25**	**100**
2	**Age (year)**	21 – less than 26	10	40	10	40
		26 – less than 31	14	56	10	40
		31 or more	1	4	5	20
		Total	**25**	**100**	**25**	**100**
		Mean ± SD	**26.4 ± 3**		**27.96 ± 6.9**	
3	**Level of education in nursing**	High school	10	40	11	44
		Diploma	6	24	11	44
		Bachelor	9	36	3	12
		Postgraduate	0	0	0	0
		Total	**25**	**100**	**25**	**100**
4	**Marital status**	Unmarried	7	28	8	32
		Married	18	72	14	56

No.	Characteristics		Study group		Control group	
			f	%	f	%
		Widowed/er	0	0	1	4
		Divorced	0	0	2	8
		Total	**25**	**100**	**25**	**100**
5	**Residency**	Urban	18	72	18	72
		Rural	7	28	7	28
		Total	**25**	**100**	**25**	**100**

No: Number, f: Frequency, %: Percentage, SD: Standard deviation

60% of the nurses in the study group and 56% of the nurses in the control group are females, according to the descriptive analysis in table 4-1.

The study group's average age for nurses is 26.43 years, with 56% of them falling within the 26–under–31 age range. The control group's nurses had an average age of 27.96 6.9 years, with 40% of them being between the ages of 21 and 26 and the same percentage between 26 and 31.

Regarding level of education in nursing, the highest percentage refers to "nursing high school" among 40% In the study group, nurses. Among The control group's nurses, 44% of them are graduated from nursing high schools and 44% are graduated with diploma degree in nursing.

72% of the nurses in the study group and 56% of the control group are married, while the remaining nurses are still single, according to the statistics on marital status. According to 72% of the nurses in the study group and 72% of the control group, more nurses reside in metropolitan areas.

Table (2): Nurses are distributed according to their professional characteristics.

No.	Characteristics		Study group		Control group	
			f	%	f	%
1	**Duty shift**	Morning	25	100	19	76
		Evening	0	0	6	24
		Total	**25**	**100**	**25**	**100**
2	**Years of service in nursing**	1 – less than 6	18	72	20	80
		6 – less than 10	7	28	2	8
		11 –less than 16	0	0	2	8
		16 and more	0	0	1	4
		Total	**25**	**100**	**25**	**100**
3	**Years of service in bone marrow aspiration wards**	1 – less than 6	25	100	25	100
		6 – less than 10	0	0	0	0
		11 and more	0	0	0	0
		Total	**25**	**100**	**25**	**100**

No: Number, f: Frequency, %: Percentage

The descriptive analysis of professional characteristics of nurses in table 4-2 shows that all nurses in the study group are working at morning shift (100%) and 76% of nurses in the control group are working at morning shift also.

More nurses with fewer than six years of experience are present, as shown by 72% of nurses in the research group and 80% of nurses in the control group. Both the study (100%) and control (100%) groups of nurses have an average of one to six years of experience working in wards for bone marrow aspiration.

Table (3): Assessment of Nurses' Knowledge about Bone Marrow Aspiration and Biopsy among Study and Control Group

List	Knowledge	Scale	Study Group (N=25)						Control Group (N=25)					
			Pre-test			Post-test			Pre-test			Post-test		
			f (%)	M	Ass.	f (%)	M	Ass.	f (%)	M	Ass.	f (%)	M	Ass.
1	Bone cavities are filled with soft (spongy) tissue called bone marrow.	Incorrect	12(48)	1.52	Fair	0(0)	2.00	Good	13(52)	1.48	Fair	1(4)	1.96	Good
		Correct	13(52)			25(100)			12(48)			24(96)		
2	There are two types of bone marrow: red bone marrow, known as myeloid tissue, and yellow bone marrow, or adipose tissue.	Incorrect	16(64)	1.36	Fair	0(0)	2.00	Good	19(76)	1.24	Poor	15(60)	1.40	Fair
		Correct	9(36)			25(100)			6(24)			10(40)		
3	Bone marrow contains stem cells.	Incorrect	12(48)	1.52	Fair	0(0)	2.00	Good	22(88)	1.12	Poor	15(60)	1.40	Fair
		Correct	13(52)			25(100)			3(12)			10(40)		
4	Marrow stromal cells are another name for mesenchymal stem cells., are found in red bone marrow. These result in the production of fat, cartilage, and bone.	Incorrect	15(60)	1.40	Fair	0(0)	2.00	Good	9(36)	1.64	Fair	12(48)	1.52	Fair
		Correct	10(40)			25(100)			16(64)			13(52)		
5	Bone marrow produces less than 100 billion new blood cells every day.	Incorrect	21(84)	1.16	Poor	0(0)	2.00	Good	15(60)	1.40	Fair	21(84)	1.16	Poor
		Correct	4(16)			25(100)			10(40)			4(16)		
6	Bone marrow remains red until about 3 years of age.	Incorrect	23(92)	1.08	Poor	0(0)	2.00	Good	21(84)	1.16	Poor	22(88)	1.12	Poor
		Correct	2(8)			25(100)			4(16)			3(12)		

7	The vertebrae, hips, and (ilium, sternum, ribs, and skull) bones contain the most red marrow.	Incorrect	9(36)			11(44)			16(64)			12(48)		
		Correct	16(64)	1.64	Fair	14(56)	1.56	Fair	9(36)	1.36	Fair	13(52)	1.52	Fair
8	White blood cells have a short lifespan—a few hours to a few days.	Incorrect	12(48)			0(0)			14(56)			9(36)		
		Correct	13(52)	1.52	Fair	25(100)	2.00	Good	11(44)	1.44	Fair	16(64)	1.64	Fair
9	Platelets live for 46 days	Incorrect	21(84)			0(0)			25(100)			25(100)		
		Correct	4(16)	1.16	Poor	25(100)	2.00	Good	0(0)	1.00	Poor	0(0)	1.00	Poor
10	Red blood cells live for 180 days.	Incorrect	10(40)			0(0)			21(84)			14(56)		
		Correct	15(60)	1.60	Fair	25(100)	2.00	Good	4(16)	1.16	Poor	11(44)	1.44	Fair
11	In reaction to infection, the bone marrow produces more white blood cells.	Incorrect	22(88)			0(0)			19(76)			14(56)		
		Correct	3(12)	1.12	Poor	25(100)	2.00	Good	6(24)	1.24	Poor	11(44)	1.44	Fair
12	The yellow bone marrow can be stimulated and changed into red bone marrow in cases of acute bleeding.	Incorrect	20(80)			0(0)			20(80)			18(72)		
		Correct	5(20)	1.20	Poor	25(100)	2.00	Good	5(20)	1.20	Poor	7(28)	1.28	Poor
13	Bone marrow aspiration is a procedure that involves taking a sample of the liquid portion of the soft tissue within the bones.	Incorrect	13(52)			0(0)			21(84)			20(80)		
		Correct	12(48)	1.48	Fair	25(100)	2.00	Good	4(16)	1.16	Poor	5(20)	1.20	Poor
14	In a bone marrow biopsy, the bone marrow's fluid and cells are removed along with a little	Incorrect	10(40)			0(0)			15(60)			15(60)		
		Correct	15(60)	1.60	Fair	25(100)	2.00	Good	10(40)	1.40	Fair	10(40)	1.40	Fair

No	Statement		n(%)	Mean	Grade	n(%)	Mean	Grade	n(%)	Mean	Grade	n(%)	Mean	Grade
	quantity of bone..													
15	Aspiration sampling is generally performed prior to a marrow biopsy.	**Incorrect**	22(88)	1.12	Poor	0(0)	2.00	Good	16(64)	1.36	Fair	17(68)	1.32	Poor
		Correct	3(12)			25(100)			9(36)			8(32)		
16	Diagnosing, classifying, and treating various malignancies and blood disorders, as well as for follow-up and rearrangement after treatment is completed through bone marrow aspiration.	**Incorrect**	5(20)	1.80	Good	0(0)	2.00	Good	8(32)	1.84	Good	8(32)	1.84	Good
		Correct	20(80)			25(100)			17(68)			17(68)		
17	Multiple bones can be used to collect a bone marrow sample., most important of which are the hip, vertebrae, sternum, and tibia for children.	**Incorrect**	13(52)	1.48	Fair	0(0)	2.00	Good	17(68)	1.32	Poor	9(36)	1.64	Fair
		Correct	12(48)			25(100)			8(32)			16(64)		
18	Samples are taken from the shinbone of children over the age of four years only	**Incorrect**	20(80)	1.20	Poor	0(0)	2.00	Good	14(56)	1.44	Fair	18(72)	1.28	Poor
		Correct	5(20)			25(100)			11(44)			7(28)		
19	It is preferable to take a bone marrow biopsy from the posterior and anterior ilium.	**Incorrect**	13(52)	1.48	Fair	14(56)	1.44	Fair	12(48)	1.52	Fair	7(28)	1.72	Good
		Correct	12(48)			11(44)			13(52)			18(72)		
20	Bone marrow aspiration and biopsy cause complications for the patient.	**Incorrect**	5(20)	1.80	Good	0(0)	2.00	Good	1(4)	1.96	Good	1(4)	1.96	Good
		Correct	20(80)			25(100)			24(96)			24(96)		
21	Bone marrow	**Incorrect**	8(32)	1.68	Good	0(0)	2.00	Good	1(4)	1.96	Good	5(20)	1.80	Good

List	Knowledge	Scale	f(%)	M	Ass.	f(%)	M	Ass.	f(%)	M	Ass.	f(%)	M	Ass.
	aspiration and biopsy cause severe bleeding, especially in people with a low platelet count	Correct	17(68)			25(100)			24(96)			20(80)		
22	A breakthrough of the sternum occurs during sternal aspiration, which can cause heart or lung problems.	Incorrect	8(32)			0(0)			7(28)			6(24)		
		Correct	17(68)	1.68	Good	25(100)	2.00	Good	18(72)	1.72	Good	19(76)	1.76	Good
23	Thrombocytopenia poses a risk to the patient prior to bone marrow aspiration and biopsy.	Incorrect	8(32)			0(0)			1(4)			1(4)		
		Correct	17(68)	1.84	Good	25(100)	2.00	Good	24(96)	1.96	Good	24(96)	1.96	Good
Total average				1.45	Fair		1.95	Good		1.43	Fair		1.51	Fair

Ass: Assessment, M: Mean, (Poor= 1-1.33, Fair= 1.34-1.67, Good= 1.68-2).

The knowledge of nurses regarding bone marrow aspiration and biopsy is shown in Table 4-4. According to the study group's findings, nurses demonstrated "fair" knowledge during the pre-test (Mean=1.45) and "good" knowledge during the post-test (Mean=1.95).

The results of the nurses in the control group suggest that nurses exhibit "fair" levels of knowledge throughout the pre-test and post-test (Mean = 1.43 and 1.51, respectively).

Table (4): Assessment Nurses' Knowledge about Nursing Care for Children with Bone Marrow Aspiration and Biopsy among Study and Control Group

List	Knowledge	Scale	Study Group (N=25)						Control Group (N=25)					
			Pre-test			Post-test			Pre-test			Post-test		
			f (%)	M	Ass.	f (%)	M	Ass.	f (%)	M	Ass.	f (%)	M	Ass.
1	The Jamshidi needle is an essential tool for a bone marrow biopsy.	Incorrect	15(60)			0(0)			17(68)			3(12)		
		Correct	10(40)	1.40	Fair	25(100)	2.00	Good	8(32)	1.32	Poor	22(88)	1.88	Good
2	The percentage of lidocaine in bone marrow aspiration and biopsy ranges from 8-10%.	Incorrect	21(84)			0(0)			16(64)			18(72)		
		Correct	4(16)	1.16	Poor	25(100)	2.00	Good	9(36)	1.36	Fair	7(28)	1.28	Poor
3	Greater understanding of bone marrow aspiration procedure and diagnostic tests helps nurse practitioners and	Incorrect	15(60)			0(0)			21(84)			19(76)		
		Correct	10(40)	1.40	Fair	25(100)	2.00	Good	4(16)	1.16	Poor	6(24)	1.24	Poor

#	Statement													
	oncology nurses provide better patient care.													
4	Hospitals perform bone marrow aspiration and biopsy procedures. and usually take 2-3 hours.	Incorrect	10(40)	1.60	Fair	0(0)	2.00	Good	18(72)	1.28	Poor	16(64)	1.36	Fair
		Correct	15(60)			25(100)			7(28)			9(36)		
5	It is not necessary to check the sensitivity of the patient	Incorrect	10(40)	1.60	Fair	0(0)	2.00	Good	7(28)	1.72	Good	9(36)	1.64	Fair
		Correct	15(60)			25(100)			18(72)			16(64)		
6	9 to 10 ml of cerebrospinal fluid is withdrawn from the patient	Incorrect	21(84)	1.16	Poor	0(0)	2.00	Good	24(96)	1.04	Poor	24(96)	1.04	Poor
		Correct	4(16)			25(100)			1(4)			1(4)		
7	It is not necessary to explain the procedure to the patient.	Incorrect	8(32)	1.84	Good	0(0)	2.00	Good	12(48)	1.52	Fair	12(48)	1.52	Fair
		Correct	17(68)			25(100)			13(52)			13(52)		
8	Ensure that the patient signs the necessary consent form prior to performing the bone marrow aspiration and biopsy.	Incorrect	3(12)	1.88	Good	0(0)	2.00	Good	0(0)	2.00	Good	3(12)	1.88	Good
		Correct	22(88)			25(100)			25(100)			22(88)		
9	For a bone marrow aspiration and biopsy, the youngster is placed on a bed table while lying on one side or their stomach.	Incorrect	14(56)	1.44	Fair	0(0)	2.00	Good	15(60)	1.40	Fair	12(48)	1.52	Fair
		Correct	11(44)			25(100)			10(40)			13(52)		
10	Clean the skin around the place where the needle will be put using an antiseptic solution. Only a little portion of the skin will be seen since a sterile drape will be wrapped around the area.	Incorrect	5(20)	1.80	Good	0(0)	2.00	Good	11(44)	1.56	Fair	9(36)	1.64	Fair
		Correct	20(80)			25(100)			14(56)			16(64)		
11	a local anesthetic is injected to numb the skin's surface where the needle will be placed. Typically, aspiration and biopsy are carried out simultaneously.	Incorrect	8(32)	1.68	Good	0(0)	2.00	Good	12(48)	1.52	Fair	10(40)	1.60	Fair
		Correct	17(68)			25(100)			13(52)			15(60)		
12	The withdrawal sample is only placed in a container (tube) and then sent to the laboratory	Incorrect	9(36)	1.64	Fair	0(0)	2.00	Good	8(32)	1.68	Good	7(28)	1.72	Good
		Correct	16(64)			25(100)			17(68)			18(72)		
13	We gently rock the needle back and forth in numerous directions and	Incorrect	15(60)	1.40	Fair	0(0)	2.00	Good	19(76)	1.24	Poor	18(72)	1.28	Poor
		Correct	10(40)			25(100			6(24)			7(28)		

No	Item	Ass	n(%)	M	Ass.	n(%)	M	Ass.	n(%)	M	Ass.	n(%)	M	Ass.
	rotate it clockwise and counterclockwise several times before slowly removing it from the bone to be sure no biopsy sample is left behind.					)								
14	After the drawing is done we apply pressure to get enough clotting. In the case of a patient with coagulation issues, this can take a few minutes or even longer.	Incorrect	18(72)	1.28	Poor	0(0)	2.00	Good	20(80)	1.20	Poor	12(48)	1.52	Fair
		Correct	7(28)			25(100)			5(20)			13(52)		
15	It is necessary to monitor the patient's vital signs and the biopsy site for signs and symptoms of infection and bleeding.	Incorrect	6(24)	1.76	Good	0(0)	2.00	Good	12(48)	1.52	Fair	8(32)	1.68	Good
		Correct	19(76)			25(100)			13(52)			17(68)		
16	Monitor the baby's vital signs every 12 hours	Incorrect	23(92)	1.08	Poor	20(80)	1.20	Poor	14(56)	1.44	Fair	15(60)	1.40	Fair
		Correct	2(8)			5(20)			11(44)			10(40)		
17	Pressure on the withdrawal site for half an hour	Incorrect	15(60)	1.40	Fair	0(0)	2.00	Good	16(64)	1.36	Fair	9(36)	1.64	Fair
		Correct	10(40)			25(100)			9(36)			16(64)		
18	Cells are evaluated according to their type	Incorrect	21(84)	1.16	Poor	16(64)	1.36	Fair	15(60)	1.40	Fair	13(52)	1.48	Fair
		Correct	4(16)			9(36)			10(40)			12(48)		
19	Giving medications such as Tramadol and Paracetamol to relieve pain during or after the operation	Incorrect	6(24)	1.76	Good	0(0)	2.00	Good	2(8)	1.92	Good	8(32)	1.84	Good
		Correct	19(76)			25(100)			23(92)			17(68)		
20	Clotting factors and platelets should be administered and given to the patient by intravenous infusion to prevent post-biopsy bleeding	Incorrect	8(32)	1.84	Good	0(0)	2.00	Good	7(28)	1.72	Good	8(32)	1.84	Good
		Correct	17(68)			25(100)			18(72)			17(68)		
	Total average			**1.51**	**Fair**		**1.93**	**Good**		**1.47**	**Fair**		**1.55**	**Fair**

Ass: Assessment, M: Mean, (Poor= 1-1.33, Fair= 1.34-1.67, Good= 1.68-2).

The knowledge of nurses regarding nursing care for children undergoing bone marrow aspiration and biopsy is presented in Table 4-5. According to the study group's findings, nurses demonstrated "fair" levels of knowledge during the pre-test (Mean=1.51) and "good" levels of knowledge during the post-test (Mean=1.93).

According to the results of the control group of nurses, these nurses demonstrated "fair" levels of knowledge throughout the pre-test and post-test (Mean: 1.47 and 1.55, respectively).:

Discussion:

The table (1) The study results displayed that most of nurses in the study group were females (60.0%) compared to those in the control group who were males (56%). This proportion reflects the governmental seeking of maximizing the proportion of female nurses and encourage them to work in the health agencies throughout Iraq.

Concerning participants' age, the mean age for participants in the study group was 26.4±3; more than half age 26-less than 31 years (56%). For the control group, the mean age was 27.96±6.9; two-fifth age 21-less than 26 years and 26-less than 31 years (40%) for each of them. These findings can be delineated when visualizing participants' educational qualification where two-fifth of them are nursing high school graduates which implies that they are mostly young compared to those who relatively older and have higher educational qualifications.

Regarding the educational qualification, the study results exhibited that two-fifth of participants in the study group were nursing high school graduates (40.0%), followed by those who hold an associate degree (diploma), and those who hold a bachelor's degree.

For the control group, less than half were both nursing high school graduates and those who hold an associate degree (44.0%), followed by those who hold a bachelor's degree. These findings reflect the agreed upon policy in Iraq within the last two decades which seek to reversing the base of hierarchy of nursing workforces in Iraq where such a base was composed of nurses with lower educational qualifications (nursing courses and nursing high school) to nurses who hold only associate and bachelor's degrees with the goal of optimizing the quality of nursing care in the health agencies throughout Iraq.

With respect to marital status, the study results displayed that most of participants in the study group were married compared to those who were unmarried. For the control group, more than half were married compared to those who were unmarried. These findings can be positively reflected on their knowledge about nursing management for children undergoing bone marrow aspiration and biopsy procedures owing to the reality of have been living a stable, content life.

The table (2) Concerning the years of service in nursing, most of participants in both the study and control groups have 1 – less than 6 years (n = 18; 72.0) for each of them.

Regarding the years of service in bone marrow aspiration wards, all participants in both the study and control groups have 1 – less than 6 years (n = 25; 100.0) for each of them. These findings can be explained to the reality that most of them in both groups age 26-less than 31 years.

The table (3) The study results displayed that the participants in the study group demonstrated "fair" level of knowledge about bone marrow aspiration and biopsy in the pre-test time, and "good" the knowledge level at the posttest.

For the control group, the study results exhibited that participants demonstrated "fair" level of knowledge in both pre-test and post-test. These finding reflect the effectiveness of the administered educational program in enhancing nurses` knowledge about bone marrow aspiration and biopsy procedures. These findings are supported by Ali et al. (2019) who carried out a pre-post quasi-experimental study on a sample of 30 nurses to assess how a teaching program affects nurses' performance related to bone marrow transplantation. The researchers concluded that after accomplishing the program, nurses' knowledge significantly has increased from 18.4 to 32.77.

The table (4) The study results revealed that nurses in the study group displayed fair" the level of knowledge about nursing care for children with bone marrow aspiration and biopsy in the pre-test time and "good" level of knowledge in the post-test.

For the control group, the study results demonstrated that the respondents displayed "fair" level of knowledge in both the pre-test and post-test times. These finding reflect the effectiveness of the administered educational program in enhancing nurses` knowledge about nursing care for children with bone marrow

References

1- Al-gbury, A. L. W. (2022). Effectiveness of an Interventional Program on Nurse's Knowledge & Practices Concerning Nursing Management for Leukemic Patients after Bone Marrow Aspiration and Biopsy at Blood Diseases Center in Medical City. Doctorate desirtation. College of nursing Baghdad university. Pp. 13-14. https://doi.org/10.53730/ijhs.v6nS1.6369

2- Al-Bahadli, F.F.K.(2019).Quality of Life for Adolescent Clients Who Undergone Bone Marrow Transplantation at the Specialized Bone Marrow Transplantation Center in Baghdad City. Indian Journal of Public Health Research and Development 10(1):852. https://doi.org/10.5958/0976-5506.2019.00166.9

3- Hosseini, S., Moeininia, F., Javadi, M. (2016). The Effect of Distraction Method on Bone Marrow Aspiration Pain: A Randomized Clinical Trial. J. Biol. College of nursing Baghdad university Today's World, 5 (1), Pp. 20-24

4- Lotodo, T., Melly, B., Wanjiku, C., Kilachi, C., Omondi, A., Kipkulei, J. (2020). Bone Marrow Aspirate and Trephine Biopsy Procedure in a Teaching and Referral Hospital in Kenya. Open Journal of Blood Diseases, 10, Pp. 124-132

5- Mohammed Alamin, A. A. (2017). Nurses' Knowledge regarding Nursing Care of Pediatric Patients with Acute Lymphoblastic Leukemia at the National Cancer Institute, University of Baghdad. Master thesis. Pp. 24-25.

6- Glennon, C. A., Woodroof, J. M., Kambhampati, S., Battershell, A. C., O'Connor, S. R., Roberts, K. B. (2018). Comparison of Bone Marrow Biopsy Specimens Obtained Using a Motorized Device and Manual Biopsy Systems. Asia-Pacific Journal of Oncology Nursing, 5(4), Pp. 394-398

7- Elmadhoun, W. M., Noor, S. K., Bushara, S. O., Almobarak, A. O., Husain, N. E., & Ahmed, M. H. (2015). Bone marrow aspiration in north Sudan: the procedure, indications and the diagnostic value. International journal of health sciences, 9(4), Pp. 434–439.

8- Bhaskar N. (2021). Bone Marrow Aspiration and Biopsy in Critical Pediatric Patients: A Pathologist's Perspective. Cureus, 13(8), P. e17423. https://doi.org/10.7759/cureus.17423

9- Proytcheva, M. (2013). Bone marrow evaluation for pediatric patients. International Journal of Laboratory Hematology. 35, pp. 283–289

10- Prakash, A., Richa, R., Narain, B. (2019). Etiological study of bone marrow aspiration cytology in children in a tertiary care government hospital in India with a special focus on adolescent females. Indian J Child Health, 6(10), pp. 569-571.

11- Awaad, M. H. (2018). A review of bone marrow examinations in Ibn Sena Teaching Hospital in Baghdad. Ann Coll Med Mosul,40 (2), pp. 69-73.

12- Padhi, S., Ravichandran, K., Varghese, R.G. et al. (2021). Bone marrow aspiration and gross appearance of trephine biopsy in routine practice: a preliminary descriptive data on 176 consecutive cases from a single tertiary care center in South India. J Hematopathol 14, 117–124 (2021). https://doi.org/10.1007/s12308-021-00449-5 .

13- Abdullah, S. H., & Khudhur, K. M., Effectiveness of an Educational Program on Nurses Knowledge toward Leukemic Patients at Baghdad Oncology Center in Baghdad City. Mosul Journal of Nursing, (2020), 8(2), 119-126.

14- Oliansk, Rizzo, J., Aplan P. (2017) The role of cytotoxic Therapy of acute Myeloid leukemia in children; evidence- based review. Biol Blood Marrow Transplant 13, pp. 1- 25

15- El-berdan, A., Ahmed, S. T., et al. (2022). Effect of Educational Guidelines on Patients' Knowledge and Practices regarding Complications Post Bone Marrow Transplantation. Egyptian Journal of Health Care, 13(2), pp. 2044-2058

16- Fauer, A. J., Choi, S. W., & Friese, C. R. (2019). The Roles of Nurses in Hematopoietic Cell Transplantation for the Treatment of Leukemia in Older. Seminars in oncology nursing, 35(6), p. 150960. https://doi.org/10.1016/j.soncn.2019.150960

17- Elgazzar, S., Qalawa, S., & Eltahry, S. (2019). The Efficiency of Evidence Based Guidelines on Performance, Perception, and Satisfaction of Patients Undergoing Bone Marrow Biopsy. International Journal of Nursing, 6(1), Pp. 72-82