BAU Journal - Health and Wellbeing

Volume 4 | Issue 1
ISSN: 2789-8288

Article 5

October 2021

ASSESSMENT OF NURSES' KNOWLEDGE AND CARE PRACTICES FOR INFECTION PREVENTION IN NEUTROPENIC PATIENTS IN BEKAA, LEBANON: A DESCRIPTIVE CROSS-SECTIONAL DESIGN

Mona Mortada
Infection Prevention and Control Student, Faculty of Health Sciences, Beirut Arab University, Beirut, Lebanon, mam249@student.bau.edu.lb

Salim Moussa
Assistant Professor, Medical Laboratory Technology Department, Faculty of Health Sciences, Beirut Arab University, Beirut, Lebanon, s.moussa@bau.edu.lb

Recommended Citation

Mortada, Mona and Moussa, Salim (2021) "ASSESSMENT OF NURSES' KNOWLEDGE AND CARE PRACTICES FOR INFECTION PREVENTION IN NEUTROPENIC PATIENTS IN BEKAA, LEBANON: A DESCRIPTIVE CROSS-SECTIONAL DESIGN," *BAU Journal - Health and Wellbeing*: Vol. 4: Iss. 1, Article 5.
DOI: https://doi.org/10.54729/2789-8288.1154

ASSESSMENT OF NURSES' KNOWLEDGE AND CARE PRACTICES FOR INFECTION PREVENTION IN NEUTROPENIC PATIENTS IN BEKAA, LEBANON: A DESCRIPTIVE CROSS-SECTIONAL DESIGN

Abstract

Neutropenia is one of the serious complications to chemotherapy that increases the risk of infection and even mortality. Nurses' knowledge about neutropenia and their care practices are essential in order to protect neutropenic patients from infection. Thus, this study aimed to assess nurses' knowledge and care practices for infection prevention in neutropenic patients in Bekaa, Lebanon. A cross-sectional descriptive research study had been conducted in five hospitals located in Bekaa district. 81 nurses had been recruited by convenience sampling. They completed the 'Nurses' Knowledge and Care Practices for Infection Control in Neutropenic Patients' questionnaire. The majority were females 77.8% (n=63), with a BS degree 65.4% (n=53) and less than 40 years old. The score of nurses knowledges about neutropenia was 18.8/30 while the mean score related to infection prevention and control practice was overall high (mean score=15.7/18). Based on the obtained results, *nurses in the five hospitals of Bekaa had a good level of infection control practices despite a moderate level of knowledge about neutropenia.*

Keywords

Neutropenic Patients, Nursing, Oncology, Infection, Control

1.INTRODUCTION

Cancer is considered as a critical worldwide public health problem (Naghdi et al., 2019a). It is regarded as the second reason for death in most developing countries (Roshandel et al., 2014). Thus, numerous efforts have been made to cure and manage cancer patients including surgery, immunotherapy, radiotherapy, hormone-based therapy, anti-angiogenic modalities, stem cell therapies and chemotherapy (Abbas & Rehman, 2018). Chemotherapy is typically used as first-line therapy for most types of cancers (Philip et al., 2019). However, despite its advantages, it has several side effects including mucositis, alopecia, nausea, vomiting, diarrhea, anorexia, localized skin reactions, and most dangerously neutropenia (Mize et al., 2014). Neutropenia is defined by an absolute neutrophil count of less than 1500 cells/mm^3 (Schwartzberg, 2006). It is seen in almost all cancer patients undergoing chemotherapy (Rolston, 2004a). It is the main cause of fatal infections in immune-compromised patients (Lequilliec et al., 2017). Neutrophils have major roles in immunity. They are viewed as the dominant line of resistance against infections and initiation of the inflammatory response. Consequently, their loss leads to severe fatal effects (Rasmy et al., 2017). Neutropenia caused increased hospitalization rates, which increases costs on patients (Schilling et al., 2011). Importantly, neutropenia was associated with 10% increase in the overall mortality in cancer patients (Georges et al., 2018). For these reasons, neutropenia and its handling have captured world public eye. In Lebanon, the incidence of cancer is the highest compared to regional countries. The level of cancer patients has yearly increased by 5.5 percent from 2005 to 2018 according to Lebanon National Cancer Registry. According to GLOBOCAN 2018, 17 294 new cases of cancer (242 cases per 100 000) and 8976 deaths due to cancer in 2018 had been recorded in Lebanon (Bray et al., 2018). A study done by Shamseddine et al., 2014 estimated that number of cancer patients will increase to total 637 cancer cases per 100,000 for both males and females by 2020. In addition, the number of cancer patients on chemotherapy in Lebanon rose from 3,648 in 2008 to 5,418 in 2013 (Elias et al., 2016). Cancer patients had a higher risk of hospitalization compared with the general population (1% vs. 0.29%) (Bitar et al., 2020). In Bekaa region, there is an estimated increase in cancer patients' number especially due to the pollution in "Litany river": high nitrate levels more than the acceptable amount (44 mg/L) were detected in water (Starobova & Vetter, 2017). In addition, the percentage of adults with cancer had increased in Bekaa according to the American university of Beirut and Lebanese University (Annual medical report, 2016). Nurses are regularly in close contact with neutropenic patients. Thus, nurses must have very decent awareness level and care performance for infection prevention and control practices, so that they can protect neutropenic patients. Their knowledge and practical skills regarding infection control should be up-to-date (Eskander et al., 2013). Today, there is a lack of studies assessing nurses' knowledge and care practice for infection prevention in neutropenic patients in Lebanon, especially in Bekaa district. Nurses' knowledge and care practice are essential to the accomplishment of the treatment plan. Therefore, it is important to assess the knowledge and practice levels regarding infection control measures of nurses caring for neutropenic patients.

2.MATERIALS AND METHODS

2.1 Study Site and Duration

The study was conducted at five private hospitals in Bekaa Lebanon between May 2020 and August 2020.

2.2 Study Design

The study design was descriptive cross-sectional study.

2.3 Study Procedure and Tool

We used convenient sampling method. The sample consisted of 81 registered Lebanese nurses who were currently working or used to work at the oncology department. Inclusion criteria consisted of having TS (Senior Technician), BS (Bachelor of Science) or master's degree in nursing with English skills and caring for cancer patients for one year at least. A unique English version questionnaire adapted from (Tarakcioglu Celik and Korkmaz, 2016) was used in order to assess the knowledge and care practices of nurses for preventing infection in neutropenic patients. The investigator Mona Mortada (Master student at Beirut Arab University) gave the questionnaire (English version) to the administration office at the five enrolled hospitals. Then, each hospital distributed the questionnaire to the eligible nurses for the study. Completed questionnaires were

collected by Mona Mortada for analysis. The sociodemographic questions were about age, gender, and education level. The questionnaire included 30 items with true and false answers on neutropenia knowledge and 18 questions on infection prevention and control practice related to neutropenic patients. Neutropenia knowledge questions (developed by Ertem as a questionnaire, in 2004 a; content of the questionnaire was approved by the nurse experts; was used to assess knowledge level of medical ward nurses in 2004; scoring was done as giving "1" point for each correct answer with maximum score of 30). The section about practice was supposed to be based on site observations but it was changed to yes/no question due to hospitals restricted access policies during the Covid-19 situation. This section was developed according to the CDC, WHO guidelines and relevant literature, items were checked as 'applied' or 'not applied'. Scoring was done in giving '1' point for 'applied' item with maximum of 18. We selected the following items from the neutropenia knowledge section for the correlational analysis with age, gender and level of education: Question1 (Q1), neutropenia is characterized by a decrease in neutrophils and thrombocytes-Question 2 (Q2), neutrophils provide the body's defense by phagocytosis of microorganisms-Question 7 (Q7), it is difficult to identify the signs and symptoms of infection in patients with neutropenia and Question 30 (Q30), nurses should inform patient and family about infection control procedures. These items present the essential knowledge that nurses who care for cancer patients must know as they will directly influence their practice.

2.4 Data Analysis and Presentation

Data was manually entered into SPSS version 24 for windows software. Descriptive statistics was used for presenting socio-demographic characteristics of participants. Chi-square test was used in order to identify the relationship between variables. P-value < 0.05 was considered statistically significant.

2.5 Ethical Consideration

This work was carried out according to the Code of Ethics of the World Medical Association (Declaration of Helsinki) and approved by the Institutional Review Board IRB at Rayak hospital. We first got acceptance from hospitals in order to collect data. Verbal consents were obtained from all participants since there was less than minimal risk. Participants' identities were kept anonymous. Statistics from the questionnaires were kept and managed in a password protected computer and only the investigators had access to it.

3.RESULTS

3.1 Socio-Demographics of Participants

Total of 81 participants (nurses) had completed the questionnaire. The majority of participants were females representing 77.8% (n=63) of the sample and 22.2% (n=18) were males. To add, 41.9% (n=34) of nurses were in the range of 20 to 30 years old, 44% (n=36) were between age 31 and 40 years old and 13.6% (n=11) were above 40 years old. 65.4% were BS educated nurses (n=53), 19.8% were TS educated (n=16), whereas 14.8% were master's degree holders (n=12) (Table.1).

Table 1: Socio-demographic characteristics of participants

Variables		Frequency (N=81)	Percentage (100%)
Age(years)	20-30	34	41.9
	31-40	36	44
	Above 40	11	13.6
Gender	Female	63	77.8%
	Male	18	22.2%
Education Level	TS	16	19.8%
	BS	53	65.4%
	Masters	12	14.8%

3.2 Knowledge About Neutropenia

The mean score for knowledge was 18.8/30 (SD=2.15) with minimum score of 14/30 and maximum score of 24/30. The majority of nurses (96.3%) knew that skin and mucous membrane must be assessed daily, 93.8% of them answered correctly that urinary catheterization must not be performed to measure the urine output, 90.1% knew that nurses should inform patient and family about infection control procedures, 81.5% of nurses knew that stomatitis may occur in neutropenic patients, and 72.1% knew about the composition of neutropenic patients' diet. However, 72.8% of them did not answer or did not give the correct answer on the following statement "If general condition of patient with neutropenia is stable, his or her vital signs can be assessed every 8 hours". 63% of them gave a wrong answer on "One of the signs of infection in patients with neutropenia is Glycosuria", also 58% of nurses did not know that it is difficult to identify the signs and symptoms of infection in patients with neutropenia. To add, 69.1% of them gave wrong answer to "During patient care gowns, masks, and gloves should be worn." (Table 2).

Table 2: Nurses' knowledge on neutropenia

Question		Expected answer	Correct answer		Incorrect answer	
			N	%	N	%
1.	Neutropenia is characterized by a decrease in neutrophils and thrombocytes.	F	53	65.4	28	34.6
2.	Neutrophils provide the body's defense by phagocytosis of microorganisms.	T	58	71.6	23	28.4
3.	A patient is classified as neutropenic when the neutrophil count is2500 cells/mm3	F	39	48.1	42	51.9
4.	Lymphoma" is one of the diseases that cause neutropenia	T	54	66.7	27	33.3
5.	Hypotension, an indicator for sepsis, is an important symptom for neutropenic patients	T	54	66.7	27	33.3
6.	If general condition of patient is stable, his or her vital signs can be assessed every 8 hours	F	22	27.2	59	72.8
7.	It is difficult to identify the signs and symptoms of infection in patients with neutropenia.	T	34	42	47	58
8.	Radiotherapy leads to neutropenia by suppressing bone marrow function.	T	66	81.5	15	18.5
9.	Patients' own flora is the most likely source of microorganisms in neutropenic patients.	T	56	68.3	25	31.7
10.	IV catheter dressings should be changed every 4 hours in neutropenic patients	F	37	45.7	43	54.3
11.	Neutropenic patients should take a shower/bath or be given a bed bath daily	F	31	38.3	50	61.7
12.	IV injections should be preferred rather than subcutaneous or intramuscular injections.	T	52	64.2	29	35.8
13.	Neutropenic patients should avoid coughing and deep breathing	F	42	51.3	39	48.7
14.	One of the signs of infection in patients with neutropenia is glycosuria.	T	30	37	51	63
15.	Enemas can be used in neutropenic patients' constipation	F	39	48.1	42	51.9
16.	Gastrointestinal system infections likely develop frequently in neutropenic patients.	T	60	74.1	21	25.9
17.	Stomatitis may occur often in neutropenic patients' oral mucosa.	T	66	81.5	15	18.5
18.	Neutropenic patients' oral care is provided with sodium bicarbonate solution.	T	57	70.4	24	29.6
19.	Neutropenic patients' oral care includes rinse of mouth three times a day.	F	33	40.7	48	59.3
20.	Drinking tap water is not recommended for neutropenic patients.	T	53	65.4	28	34.6
21.	Neutropenic patients' diet includes plenty of fresh vegetables and fruits to meet vitamins needs.	F	59	72.1	22	27.9
22.	Respiratory isolation is used with neutropenic patients.	F	40	49.4	41	50.6
23.	Nobody should get in neutropenic patient's room except health care providers.	F	59	72.8	22	27.2
24.	Neutropenic patients must be placed in private rooms.	T	58	71.6	23	28.4
25.	Neutropenic patient rooms should be cleaned after other ward areas by the cleaning staff.	F	41	50.6	40	49.4
26.	Floor must be cleaned with a damp mop	T	49	60.5	32	39.5
27.	During patient care gowns, masks, and gloves should be worn.	F	25	30.9	56	69.1
28.	Urinary catheterization must be performed to measure the urine output.	F	76	**93.8**	5	6.2
29.	Skin and mucous membranes should be assessed daily and documented.	T	78	**96.3**	8	3.7
30.	Nurses should inform patient and family about infection control procedures	T	73	**90.1**	8	9.9

3.3 Nurses' Infection Control Care Practice Assessment

The scores were overall high (mean score=15.7/18), specifically regarding: Hand hygiene after administration of medications (100%), Hand hygiene before administration of medications (98.8%), "Administration of oral medications without hand contact" (97. 5%), parenteral medication administration sterility (96.3%), gloves removal and hand hygiene (96.3%), sterility of drugs and other equipment before usage (92.6%), and hand hygiene before patient contact (90.1%). However, 29.6% of nurses said that they practiced neither hand hygiene after patient contact nor disinfection of mercury-in-glass thermometer before use (23.5%), (63.2%) of nurses respected patient-specific sphygmomanometer use (Table 3).

Table 3: Nurse's practice questionnaire answers

Questions	Applied		Not applied	
	N	%	N	%
Assessment of Vital Signs				
Hand hygiene before patient contact	73	**90.1**	8	9.9
Patient-specific sphygmomanometer use	51	63.2	29	35.8
Patient-specific stethoscope use	65	80.2	15	18.5
Probe change of tympanic membrane thermometer	64	79	17	21
Disinfection of mercury-in-glass thermometer before use	61	75.3	19	23.5
Hand hygiene after patient contact	57	70.4	24	29.6
Disinfection of non-patient specific devices before use	72	88.9	9	11.1
Medication Preparation				
Hand hygiene before withdrawing medications from medication system	66	81.5	19	18.5
Maintaining safe environment	78	96.3	3	3.7
Hand hygiene before preparing medications	70	86.4	11	13.6
Sterility check for drugs and other equipment before use (Syringes/needles/mini fluid bags, plastic bags, etc.)	75	**92.6**	5	6.3
Preparation of parenteral medications without breaking sterility	72	88.9	7	8.6
Preserving sterility during insertion of infusion set's spike into the solution bag	76	**93.8**	5	6.2
Medication Administration				
Hand hygiene before administration of medications	80	**98.8**	1	1.2
Administration of oral medications without hand contact	79	**97.5**	2	2.5
Administration of parenteral medications with preserving sterility	78	**96.3**	3	3.7
Hand hygiene after administration of medications	81	100	0	0
Glove's removal and hand hygiene	79	**96.3**	2	2.5

3.4 Relation Between Age and Nurses' Knowledge On Neutropenia

In this part, four major questions were only considered:

- Question1 (Q1), neutropenia is characterized by a decrease in neutrophils and thrombocytes.
- Question 2 (Q2), neutrophils provide the body's defense by phagocytosis of microorganisms.
- Question 7 (Q7), it is difficult to identify the signs and symptoms of infection in patients with neutropenia.
- Question 30 (Q30), nurses should inform patient and family about infection control procedures.

Nurses whose age was above 40 were the most knowledgeable concerning neutropenia characteristics compared to other groups. This might be explained by the fact that knowledge level got improved with years of experience. However, the majority didn't know that signs and symptoms of infections in neutropenic patients were not easy to be identified (Table 4). According to chi-square test regarding relation between age and questions (Q1, Q2, Q7, Q30), there was no significant relationship between increase of age and nurses 'knowledge on neutropenia (P>0.05) (Table 4).

Table 4: Correlation between age and nurses' knowledge on neutropenia

	% of correct answer for each question			
Age (years)	Q1: Neutropenia is characterized by a decrease in neutrophils and thrombocytes	Q2: Neutrophils provide the body's defense by phagocytosis of microorganisms.	Q7 It is difficult to identify the signs and symptoms of infection in patients with neutropenia.	Q30 Nurses should inform patient and family about infection control procedures.
20-30	73.5	67.5	35.3	91
31-40	54.1	62	51	86
Above 40	80	90	30	100
χ^2	4.04	3.63	1.27	3.55
P-value	0.133	0.159	0.529	0.082

$\chi 2$: Chi-square, $p<0.05$ is statistically significant

3.5 Relation Between Gender and Nurses' Knowledge On Neutropenia

Females got higher percentages of correct answers than males in questions (Q2, Q7, Q30), with (74.1%> 61.1% ,44.4% > 33% ,92.3% >82%) respectively (Table 4). According to chi-square test, there is no significant relationship between the gender of nurses and their knowledge regarding neutropenia. (P>0.05) (Table 5).

Table 5: Correlation between gender and nurse's knowledge on neutropenia

Gender	Q1: Neutropenia is characterized by a decrease in neutrophils and thrombocytes	Q2: Neutrophils provide the body's defense by phagocytosis of microorganisms.	Q7 It is difficult to identify the signs and symptoms of infection in patients with neutropenia.	Q30 Nurses should inform patient and family about infection control procedures.
Male	67	61.1	33.3	82
Female	65.1	74.1	44.4	92.3
χ^2	0.16	1.25	0.39	1.89
P-value	0.9	0.26	0.54	0.16

$\chi 2$: Chi-square, $p<0.05$ is statistically significant

3.6 Relation Between Education Level and Nurses' Knowledge On Neutropenia

Nurses with a Master's degree had the best scores in questions (Q1, Q2, Q30) (66.5%,100%, 100%) (p=0.05) and those with a Senior Technician degree got the highest score in question 7 (75%) (p=0.02) (Table. 6).

Table 6: Correlation between level of education and nurse's knowledge on neutropenia

Education level	Q1: Neutropenia is characterized by a decrease in neutrophils and thrombocytes	Q2: Neutrophils provide the body's defense by phagocytosis of microorganisms.	Q7: It is difficult to identify the signs and symptoms of infection in patients with neutropenia.	Q30: Nurses should inform patient and family about infection control procedures.
TS	50	62	75	81
BS	37	67.9	34	90.6
Masters	66.7	100	25	100
χ^2	2.1	5.7	7.4	1.51
P -value	0.3	0.05	*0.02	0.4

χ^2: Chi-square, $p<0.05$ is statistically significant, (*: $p<0.05$).

3.7 Relationship between socio-demographic characteristics and infection prevention and control practice

In this part, the answers to these following questions were only considered:

- Hand hygiene before patient contact
- Sterility check for drugs and other equipment before use Syringes/ needles/ mini fluid bags, plastic bags, etc.
- Hand hygiene before administration of medications
- Administration of parenteral medications with preserving sterility

Nurses who were of age group above 40 were applying 100% three of the four infection prevention and control practices except for "Sterility check for drugs and other equipment before use Syringes/ needles/ mini fluid bags, plastic bags, etc." where their answers were 90% (Table 7). Female nurses' answers were almost the same as the answers of males gender on this part (between 84.1 and 100%) (table7). Finally, nurses with a Master degree had the greatest answers (100%) on all parts of questions (table 7). According to chi-square correlation, there is no significant correlation between socio-demographic characteristics (gender, age and education) and infection prevention and control practice (Table 7).

Table 7: Correlation between nurses' practice, age, gender and education level

		% of applied cases			
Groups		Hand hygiene before patient contact	Sterility check for drugs and other equipment before use Syringes...	Hand hygiene before administration of medications	Administration of parenteral medications with preserving sterility
Age(years)	20-30	79.4	912	97.1	94.1
	31-40	86.5	94.6	100	100
	Above 40	100	90	100	100
χ^2		**1.66**	**0.41**	**1.4**	**2.1**
p-Value		**2.6**	**0.81**	**0.49**	**0.22**
Gender	Male	88.9	94.4	88.9	100
	Female	84.1	100	84.1	95.2
χ^2		**0.25**	**0.41**	**1.4**	**2.9**
p-Value		**0.61**	**0.81**	**0.49**	**0.22**
Level of Education	TS	79.4	100	100	100
	BS	86.5	78.7	98.4	94.3
	Master	100	100	100	100
χ^2		**2.4**	**3.4**	**0.5**	**1.6**
p-Value		**0.2**	**0.18**	**0.7**	**0.4**

χ^2: Chi-square, $p<0.05$ is statistically significant.

3.8 Correlation between nurses' knowledge on neutropenia and infection prevention and control practice

According to chi-square, there is no relationship between nurse's knowledge on neutropenia and the four items related to infection prevention and control practice ($p>0.05$) (Table 8).

Table 8: Correlation between nurses' knowledge on neutropenia and infection prevention and control practice

Score about Neutropenia knowledge (/30)		Low score (0-14)	Average Score (15-20)	Good Score (21-25)	High Score (26-30)	χ^2	p-Value
Hand hygiene before patient contact	Applied (N)	7	52	9	1	5.92	0.11
	Not-applied (N)	1	6	5	0		
Sterility check for drugs and other equipment before use Syringes, etc.)	Applied (N)	7	55	12	1	1.77	0.62
	Not-applied (N)	1	3	2	0		
Hand hygiene before administration of medications	Applied (N)	8	57	14	1	0.40	0.94
	Not-applied (N)	0	1	0	0		
Administration of parenteral medications with preserving sterility	Applied (N)	8	55	14	1	1.23	0.74
	Not-applied (N)	0	3	0	0		

χ^2: Chi-square, $p<0.05$ is statistically significant.

4.DISCUSSION

The majority of participants in this study were young female nurses with bachelor degrees or equivalent. This is not uncommon among nurses as found in several previous studies (Ayed et al., 2015). The study showed that the mean score of nurses' answers concerning knowledge of neutropenia was moderate (18/30). To start: the answers of the definition of neutropenia were average same as the study done by Nadeem Khokhar et al., 2020 but greater than a study done by Foubert et al., 2005, which showed that low number of nurses only knew the characterization of neutropenia. Only 48.1% knew that a patient is not classified neutropenic when neutrophil count is 2500 cell/mm^3 which less than what nurses answered in a study done by Celik & Korkmaz, 2016. Unfortunately, this indicates that nurses in these hospitals of Bekaa were not well educated about neutropenia and need further trainings. The rate of correct answers of nurses to the following questions (6, 7, 11, 14, 19, 27) was low except for the items related to assessment of Foley, place of patient, and informing to patient's parents of procedures which were very high (8,17, 24,28,29,30), same as a study done by Naghdi et al., 2019 in contrast with a study done by Kamunge et al., 2015 which revealed that more than 1/3 of nurses answered most of questions correctly. This part of the questionnaire is important because it reveals the level of education of nurses on neutropenia.

It is expected from nurses who work with such critical patients to know at least this information since it is a life-threatening issue in cancer patients. As for the sign of infection in neutropenic patients, the percentages of correct answers were low concerning knowing symptoms of infection but were moderate regarding assurance that it is difficult to indicate signs and symptoms of infection during neutropenia. Regarding oral care, nurses knew that it must be done by sodium bicarbonate, but didn't know the correct frequency only forty percent of nurses knew the correct answer same as a study done in Jordan that showed that half of the staff nurses had poor knowledge regarding oral care in cancer patients (Pai & Ongole, 2015). As for other basic information regarding patient's hygiene and behavior such as drinking tap water, eating fresh vegetables, deep breathing and cough, results were high which is a good point since all patients especially neutropenic patients rely on their nurses in several ways specially to guide them through their routine activities. Regarding infection control practice, the percentage of nurses who said that they applied "Hand hygiene after patient contact" was moderate. Hands are the major source of transmitting microorganisms by direct and indirect contact (Mathur, 2011). Simply by washing hands either by alcohol or soap and water infection can be prevented (Vermeil et al., 2019). Thus, nurses should be taught all the movements of hand hygiene. Regarding "patient-specific sphygmomanometer", sixty three percent only reported that they respected it. Medical equipment, such as sphygmomanometer, should be single-use or specific to neutropenic patients; if this is not conceivable, proper cleaning method is essential for the prevention of infection spread. A study done in an Indian tertiary care hospital revealed that 86% of stethoscopes were contaminated with pathogens (Jain et al., 2013). Also, David Zargaran indicated that bacterial organisms such as Staphylococcus and diphtheroids were found in majority of the 120 blood pressure cuffs which were assessed in the general hospital in London (Zargaran et al., 2015). Thus, neutropenic patients' must have their own sphygmomanometer or at least it must be properly cleaned by nurses between each patient to reduce infections caused by it. The percentage of nurses who told that they were following the infection control recommendation related to medication preparation were high except for hand hygiene before withdrawing medication which was relatively low. Interestingly, these results still higher than a study done in a hematology ward (University Hospital Basel, Switzerland) which revealed that compliance of hand hygiene before aseptic tasks appeared to be unacceptable low even at wards caring for high-risk patients (Scheithauer et al., 2013). Nurses with TS degree were the best to know that identifying signs and symptoms of infection in neutropenia was a difficult task. However, those with a Master degree were the best to know the function of neutrophils in body. These results could be explained by the differences in curricula among academic programs, where TS track focused more on practical skills and Master track on theories. Over all nurse's infection prevention and control practice was good (mean=15.7/18, SD+1.5), but this is not enough. Intriguingly, the infection prevention and control performance of nurses was much better than their knowledge on neutropenia scores. This is surprising since practice should reflect the knowledge level and it was not the case. In this study there was none consistency between nurses' knowledge on neutropenia and their infection control practice. This might be explained by the fact that nurse's practice was assessed through questionnaire and not direct observation, where some participants gave a desirable answer rather than report on actual infection control practice. Another reason to explain the high score in practice section compared to knowledge about neutropenia is that several hospitals were focusing on nurse's infection prevention and control practice in order to abide with requirements to get accreditations. The current Covid 19 outbreak also forced nurses to apply the best practice for infection prevention especially towards neutropenic patients like hand hygiene and proper medication preparation. In the contrary, some studies showed that despite nurses had high knowledge, their performance of infection prevention and control had been unacceptable (Tarakcioglu Celik & Korkmaz, 2016).

5. LIMITATIONS

The observation phase (part II of questionnaire) was substituted by self-administered questionnaire since access to hospital was forbidden due to COVID 19 outbreak. Also, few hospitals and small sample size prevented the generalization of the findings to all hospitals in Bekaa. In addition to social desirability, the majority of nurses in the present study were females (convenient sampling). Finally, the psychometric properties, reliability and validity of questionnaire were not available (Tarakcioglu Celik and Korkmaz, 2016).

6. CONCLUSION

This study showed that the nurses' overall knowledge of neutropenia was moderate. However, their infection control practices levels were high. We recommend more studies to investigate the reasons of the gap between knowledge and practice levels and to observe nurses' practice, also insert neutropenia in nurse's curriculum and shed light on its importance.

7. ACKNOWLEDGEMENT

The authors would like to thank the administration of hospitals for giving the agreement to proceed this research.

REFERENCES

- Abbas, Z., & Rehman, S. (2018). An Overview of Cancer Treatment Modalities. *Neoplasm*.
- Ayed, A., Fashafsheh, I., Eqtait, F., & Harazneh, L. (2015). Knowledge and Practice of Nursing Staff towards Infection Control Measures in the Palestinian Hospitals. *Journal of Education and Practice*, *6*.
- Bitar, N., Kattan, J., Kourie, H. R., Mukherji, D., & Saghir, N. E. (2020). The Lebanese Society of Medical Oncology (LSMO) statement on the care of patients with cancer during the COVID-19 pandemic. *Future Oncology*, *16*(11), 615–617.
- Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, *68*(6), 394–424.
- Elias, F., Khuri, F. R., Adib, S. M., Karam, R., Harb, H., Awar, M., Zalloua, P., & Ammar, W. (2016). Financial Burden of Cancer Drug Treatment in Lebanon. *Asian Pacific Journal of Cancer Prevention: APJCP*, *17*(7), 3173–3177.
- Eskander, H. G., Youssef, W., Morsy, M., & Elfeky, H. (2013). Intensive care nurses' knowledge & practices regarding infection control standard precautions at a selected Egyptian Cancer Hospital. *J Educ Pract*, *4*, 160–174.
- Foubert, J., Kearney, N., Ouwerkerk, J., Uhlenhopp, M., & Vaessen, G. (2005). Knowledge of haematological toxicities amongst European nurses—A learning needs assessment. *European Journal of Oncology Nursing: The Official Journal of European Oncology Nursing Society*, *9*(3), 239–247.
- Georges, Q., Azoulay, E., Mokart, D., Soares, M., Jeon, K., Oeyen, S., Rhee, C. K., Gruber, P., Ostermann, M., Hill, Q. A., Depuydt, P., Ferra, C., Toffart, A.-C., Schellongowski, P., Müller, A., Lemiale, V., Tinquaut, F., Bourmaud, A., & Darmon, M. (2018). Influence of neutropenia on mortality of critically ill cancer patients: Results of a meta-analysis on individual data. *Critical Care*, *22*(1), 326.
- Jain, A., Shah, H., Jain, A., & Sharma, M. (2013). Disinfection of stethoscopes: Gap between knowledge and practice in an Indian tertiary care hospital. *Annals of Tropical Medicine and Public Health*, *6*, 236–239.
- Kamunge, E., Cahill, T., Zipp, G., & Parasher, R. (2015). Knowledge, attitudes and practices of registered nurses regarding the spread of nosocomial infections and the impact of organizational support. *Antimicrobial Resistance and Infection Control*, *4*(Suppl 1), P60.

- Khokhar, N., Parveen, K., Afzal, M., & Gilani, S. A. (2020). Assess the Nurses Knowledge and Standard Practice Regarding the Prevention of Infection in Neutropenic Patients. *Journal of Health, Medicine and Nursing*, *77*(0), 28–41.
- Lequilliec, N., Raymond, R., Vanjak, D., Baghdadi, N., Boulestreau, H., Zahar, J.-R., & Gangneux, J.-P. (2017). Practices of infectious control management during neutropenia: A survey from 149 French hospitals. *Journal de Mycologie Médicale*, *27*(2), 227–231.
- Mathur, P. (2011). Hand hygiene: Back to the basics of infection control. *The Indian Journal of Medical Research*, *134*(5), 611–620.
- Mize, L., Harris, N., Stokhuyzen, A., Avery, T., Cash, J., Kasse, M., Sanborn, C., Leonardelli, A., Rodgers, C., & Hockenberry, M. (2014). Neutropenia Precautions for Children Receiving Chemotherapy or Stem Cell Transplantation for Cancer. *Journal of Pediatric Oncology Nursing*, *31*(4), 200–210.
- Naghdi, H., Azizzadeh Forouzi, M., & Dehghan, M. (2019a). Iranian Nurses' Knowledge of Neutropenia and Their Practice for Infection Prevention in Patients with Cancer. *Journal of Cancer Education*.
- Naghdi, H., Azizzadeh Forouzi, M., & Dehghan, M. (2019b). Iranian Nurses' Knowledge of Neutropenia and Their Practice for Infection Prevention in Patients with Cancer. *Journal of Cancer Education*.
- Pai, R. R., & Ongole, R. (2015). Nurses' Knowledge and Education about Oral Care of Cancer Patients Undergoing Chemotherapy and Radiation Therapy. *Indian Journal of Palliative Care*, *21*(2), 225–230.
- Rasmy A, Al Mashiakhi M, Ameen A. Chemotherapy-Induced Febrile Neutropenia in Solid Tumours. Gulf J Oncolog. 2017 Sep;1(25):77-84. PMID: 29019336.
- Rolston, K. V. I. (2004). Management of Infections in the Neutropenic Patient. *Annual Review of Medicine*, *55*(1), 519–526.
- Roshandel, G., Boreiri, M., Sadjadi, A., & Malekzadeh, R. (2014). A Diversity of Cancer Incidence and Mortality in West Asian Populations. *Annals of Global Health*, *80*(5), 346.
- Scheithauer, S., Batzer, B., Molina, C. P., & Widmer, A. (2013). P132: Hand hygiene "before aseptic tasks": a critical point even at a hematology and transplant ward. *Antimicrobial Resistance and Infection Control*, *2*(S1), P132, 2047-2994-2-S1-P132.
- Schilling, M. B., Parks, C., & Deeter, R. G. (2011). Costs and outcomes associated with hospitalized cancer patients with neutropenic complications: A retrospective study. *Experimental and Therapeutic Medicine*, *2*(5), 859–866.
- Schwartzberg, L. S. (2006). Neutropenia: Etiology and Pathogenesis. *Clinical Cornerstone*, *8*, S5–S11.
- Shamseddine, A., Saleh, A., Charafeddine, M., Seoud, M., Mukherji, D., Temraz, S., & Sibai, A. M. (2014). Cancer trends in Lebanon: A review of incidence rates for the period of 2003–2008 and projections until 2018. *Population Health Metrics*, *12*, 4.
- Starobova, H., & Vetter, I. (2017). Pathophysiology of Chemotherapy-Induced Peripheral Neuropathy. *Frontiers in Molecular Neuroscience*, *10*.
- Tarakçıoğlu Çelik, G., & Korkmaz, F. (2016). Nurses' Knowledge and Care Practices for Infection Prevention in Neutropenic Patients. *Contemporary Nurse*, *53*, 1–27.
- Vermeil, T., Peters, A., Kilpatrick, C., Pires, D., Allegranzi, B., & Pittet, D. (2019). Hand hygiene in hospitals: Anatomy of a revolution. *Journal of Hospital Infection*, *101*(4), 383–392.
- Zargaran, D., Hardwick, S., Adel, R., Hill, G., Stubbins, D., & Salmasi, A. M. (2015). Sphygmomanometer cuffs: A potential source of infection! *Angiology*, *66*(2), 118–121.