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Research Article

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Nurses Intervention Regarding Caring for Patients with Esophageal Varies During Endoscopy at Zagazig University Hospital

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ABSTRACT

Background and aim of the Work: Gastrointestinal (GI) endoscopy is an important method for diagnosing and treating diseases. Endoscopes are multifaceted and reusable devices. The conception of infection control in the context of endoscopy is vital in decreasing the transmission of infections. The infection control educational program has been the most real and significant for refining the nurses' knowledge and practice which is helpful to the patients with esophageal that varies during endoscopy. This study's aim was to evaluate the effect of nurses' intervention regarding caring for patients with esophageal at Zagazig University Hospital.
Subjects and Methods: A quasi experimental design was employed in this study. The study was directed in endoscopy unit, at Zagazig University Hospital. The study samples were all the available endoscopy nursing staff. The study lasted from the beginning of Jun 2017 to the end of March in 2018.
Results: The findings showed that, slightly more than 50% of nurses were in the age group of more than 40 years with the mean age of 38.7 ± 10.7, while slightly more than 50% of the nurses had more than 10 years of practice. There was an enhancement in the entire level of nurses' knowledge and practice concerning the infection control with the highly significant noteworthy change between the pre– and post-programs regarding the infection control.
Conclusion: It could be concluded that the establishment of the health educational program improved the nurses' knowledge and practice concerning the endoscopy infection. In recommendations, continued educational infection dominance training programs have been suggested in in the endoscopy units. Hence, the integrate of such interventions would be applied in all the endoscopy units all over Egypt.

Keywords: *Educational Training Program, Gastrointestinal Endoscopy, Infection control, Endoscopy Reprocessing*

INTRODUCTION

Portal hypertension is a common clinical syndrome, distinct by a pathologic raise in the portal venous pressure, in which the hepatic venous pressure gradient (HVPG) is enlarged overhead the standard values (1-5 mmHg). In cirrhosis, portal hypertension results from the groupings of a raised intrahepatic vascular resistance and excess blood flow over the portal venous system. When the HVPG increases, exceeding 10 mmHg, the problems of portal hypertension can arise. Consequently, this value characterizes the threshold for defining the portal hypertension as being clinically weighty, and plays a crucial role in the transition from the preclinical to the clinical phase of the disease [1, 2].

Three phases of esophageal varices are Pre-hepatic, intrahepatic and extrahepatic. They include Pre-hepatic portal vein thrombosis, splenic vein thrombosis, cavernous transformation of the portal vein, splenic arteriovenous fistula, and idiopathic tropical splenomegaly [3].

Esophageal varices could cause shock, various infections like pneumonia, peritonitis, and bloodstream infection when left untreated. Patients and their physicians should be vigilant [4]. Over half of the patients hospitalized because of esophageal varices that are diagnosed with an infection [5]. The rate of mortality in patients with esophageal varices is high with 20-35 percent.

The health care workers should understand the predictors of esophageal variceal bleeding, and recognize the threat population for screening [6]. It is essential for nursing staff, and the health care group to detect lab values, and remark the follow lab anomaly and the patients' symptoms to their physician. The above liver enzymes are situated inside liver cells, and if the liver is injured or spoiled, the liver cells shed these enzymes into the blood, raising the AST and ALT enzyme blood levels indicating liver damage [6].

Other central lab values and patient symptoms to assess include: Serum albumin, portal vein diameter, PT/PTT, platelet counts, abdominal girth (ascites), spleen size. Signs, and symptoms of esophageal varices are not restricted to: Paleness, light-headedness or faint sensation, dark/bloody stools, bloody stools, symptoms of chronic liver disease, bloody emesis. Some patients with chronic liver disease and esophageal varices may not experience any symptoms at all. Signs of esophageal varices include : Bloody or black stool by rectal exam, hence the patient with signs of any chronic liver illness should be observed, and checked for quick heart rate and low blood pressure [7].

The top option of treatment is to control and then stop the bleeding, as unchecked bleeding can cause patients to bleed uncontrollably, go into shock, and then die [4]. If the bleeding is severe, the patient must be placed on a ventilator to support the airways and control the flow of blood away from the lungs. Severe dangerous blood release from esophageal varices can be treated with blood clotting medication. Doctors can also accomplish the band litigation, where an elastic band is accustomed isolate the bleeding vein and gain maneuverability over the release of blood [7].

Endoscopy nurses play a serious role in the donation of safe, and high quality endoscopy. Nurses have many responsibilities. To prepare the endoscopic room with the exact device and essential procedures for inspection of the upper or lower GI tract, is very vital. It is also essential that the nurse offers the right information about the technique to the patient, to release anxiety and give descriptions about the modality of the endoscopic process [8].

Throughout the process, the nurse should service the endoscopist and, when indicated, the anesthesist. After the completion of the procedure, the nurse should go on with the reprocessing of the endoscopic device and of the tools. Specialized and devoted nurses who follow the courses to keep up-dated are substantial in this field due to the continuous evolution of the endoscopic instruments and methods. Possible problems must be considered to be documented and to be treated in an early phase. The endoscopy-trained nurse must know the anatomy of the examined segments but must however integrate this knowledge with the care of the patients. Nurses should also get involved in the clinical investigations concerning endoscopy [9].

SUBJECTS AND METHODS

Quasi-experimental design was used in carrying out the study to evaluate the effects of an educational program on improving nurses' knowledge and practice regarding caring for patients with esophageal varices during endoscopy At Zagazig University Hospital. Field work of this study was executed in 8 months, starting from Jun 2017 to the end of March in 2018

Subjects:

The subjects of the study compromised of all the available endoscopy nursing staff (excluding the nurses involved in the pilot study) in El-salam Hospital (13 nurses), and Zagazig University Hospital (21 nurses).

Tools for data collection:

Two tools were used for data collection:

- Tool I : A Structured interview questionnaire was designed for nurses by the researcher after reviewing the related literature and the opinions of experts to access the content validity, it included the following four parts :
  - ✓ Part 1 : Demographic characteristics of patients e.g. (age, education, occupation, experience in endoscopy unit, training course regarding infection… etc)
  - ✓ Part 2 : Endoscopy nurses' knowledge regarding esophageal varices, definition, causes, rick group, diagnosis, complication, treatment, nursing care, universal precautions, principles of aseptic technique, hand wash, waste management, nurses' knowledge on cleaning, level of disinfection, sterilization, and endoscopy reprocessing.

- ✓ Part 3: Life style habites of patients (Pre/ Post/follow up test). It included nutritional habits, physical activity, weight control, etc).
- ✓ Part 4: Patients' knowledge regarding hypertension (Pre/ Post / follow up test). It included the meaning of the blood pressure reading, the normal value of Bp for adults, hypertension as a chronic disease, primary hypertension as the most common type, etc.

- Tool II: An observational checklist (Appendix II): (pre-post format)

It was used to assess nurses' practices of before, during, and after the instructions for GI endoscope checklist.

Educational program in endoscopy unit:

It was designed by the researcher after reviewing the related literature to evaluate the nurses' knowledge, and practice related to caring for patient with esophageal varices during endoscopy. The study lasted for 8 months.

Content validity and Reliability:

Content validity was assessed for the modified tools and the designed booklet to determine whether the tools covered the aim or not. It was evaluted by a jury of 5 experts, and four professors from faculty of Nursing, Zagazig University and 2 professors from the Faculty of Medicine, Zagazig University. The reliability was assessed by using Guttman split-half test and retest. It was done to examine whether the observation checklist and the assessment scale had the internal consistency or not. The test was done and the agreement percentage was 96.2%.

The implementation phase for data collection was started as following: The data collection, and the implementation of the educational program on nurses lasted over a period of 8 months, starting from July 2017 to march 2018, one month for doing the pre- test (from the beginning of July, 2017 to the end of August, 2017), six months for the implementation of the program and the posttest (from the beginning of August 2017 to the end of February 2018), 1 months after the posttest (from the beginning of March to the end of March 2018). The questionnaire sheet was designed by the researcher. Data used were collected in four days from the endoscopy unit, from 9:00 am to 1:00 pm where the program was implemented. The nurses were grouped; each group included 4-5 nurse. It was necessary for the researcher to introduce herself to the nurse, and explain the purpose of the study. The data was collected in a simplified Arabic language. The study program consisted of 16 sessions; one session to identify the objective and the importance of the program. One third of the sessions (5) were theoretical, and two thirds (9) were practical, and one session was for the revision. Each interview took approximately 30 minutes in each theoretical session, and 30-45 minutes in each practical session. The theoretical sessions were followed by the practical sessions.

Administrative and Ethical considerations:

The study was ethically approved by the dean of the faculty of Nursing, the manager of Zagazig University Hospitals, and the heads of endoscopy units.

Statistical Design:

All collected data were organized, categorized, tabulated, entered, and analyzed by using SPSS (Statistical Package for Social Sciences); a software program version 14 was applied to analyze the frequency tables and their statistical significance. The statistical significance and associations were assessed using the arithmetic mean, the standard deviation (SD), Wilcoxon Signed Ranks test (Z test), Independent sample t test (T test), Pearson chi-square test (X2) and Pearson Correlation (r) to detect the relation between the variables.

RESULTS

The first part of the results was related to the demographic characteristics of nurses including the demographic data of the endoscopy nurses under the study covering their age, sex, education level, knowledge in endoscopy unit, courses attended for the infection control, and the vaccination of hepatitis (Table 1).

The second part of the results was concerned with the highly statistical improvement in the knowledge of nurses concerning Esophageal varices with Mean±SD of 7.5±4.4 pre nursing intervention increased to Mean±SD 83.7±3.9 post nursing intervention, endoscopy Mean±SD 25.9±1.0 pre nursing intervention increased to Mean±SD 86.6±3.1 post nursing intervention, nurse role Mean±SD 25.1±6.7 pre nursing intervention increased to Mean±SD 95.0±4.7post nursing intervention , general precautions Mean±SD 82.2±8.2pre nursing intervention increased to Mean±SD 99.5±3.2 post nursing intervention, Cleaning/disinfecting endoscope Mean±SD 46.8±4.5 pre nursing intervention increased to Mean±SD 97.7±10.9 post nursing intervention, total knowledge Mean±SD 37.5±2.3 pre nursing intervention increased to Mean±SD 92.5±3.4 post nursing intervention , at $p \leq 0.001$ (Table 2).

Table 1. Demographic characteristics of nurses in the study sample (n=35)

	Frequency	Percent
Age:		
<40	21	60.0
40+	14	40.0
Range	26.0-58.0	
Mean±SD	38.7±10.7	
Median	35.0	
Nursing qualification:		
Diploma	31	88.6
Bachelor	4	11.4
Experience years in nursing:		
<20	22	62.9
20+	13	37.1
Range	7.0-35.0	
Mean±SD	15.0	
Median		
Experience years in hematemesis unit:		
<10	19	54.3
10+	16	45.7
Range	0.0-21.0	
Mean±SD	7.6±5.7	
Median	8.0	
Experience years in endoscopy unit:		
<5	18	51.4
5+	17	48.6
Range	0.0-25.0	
Mean±SD	5.7±6.0	
Median	4.0	
Attended training courses:		
No	17	48.6
Yes	18	51.4
Had HBV vaccination:		
No	1	2.9
Yes	34	97.1

The third part of the results was concerned with the highly statistical improvement in practice of nurses in patient preparation: Pre-procedure: Mean±SD (28.6±6.1) of the total patient preparation pre nursing intervention increased to the Mean±SD (82.5±7.9) post nursing intervention, Pre-procedure infection control: the Mean±SD (25.7±44.3) of wearing overshoes pre nursing intervention increased to Mean±SD (100.0±0.0) post nursing intervention, the Mean±SD (0.0±0.0) of wearing mask/goggles pre nursing intervention increased to the Mean±SD(83.8±2.8) post nursing intervention, the Mean±SD (8.8±0.7) of washing hands pre nursing intervention increased to the Mean±SD (92.3±4.2) post nursing intervention., the Mean±SD (2.3±4.0) of wearing sterile gown pre nursing intervention increased to the Mean±SD (87.5±8.6) post nuring intervention, the Mean±SD (0.0±0.0) of wearing sterile gloves pre nursing intervention increased to the Mean±SD (91.4±5.9) post nursing intervention, during the procedure: the Mean±SD (2.9±16.90) of adhering to IC infection control pre nursing intervention increased to the Mean±SD(100.0±0.0) post nursing intervention ; post procedure: the Mean±SD (9.8±3.7) of total infection control pre nursing intervention increased to the Mean±SD (96.2±0.7) post nursing intervention, Mean±SD (24.4±1.1) of the total practice pre nursing intervention increased to the Mean±SD(92.7±2.4) post nursing intervention, at p≤ 0.001.(Table 3).

Table 2. Nurses' scores of total knowledge throughout intervention (n= 35)

Total knowledge of	Pre (n=35)		Post (n=35)		Mann Whitney test	p-value
	Mean±SD	Median	Mean±SD	Median		
Esophageal varices	7.5±4.4	9.50	83.7±3.9	81.00	55.89	<0.001*
Endoscope	25.9±1.0	25.90	86.6±3.1	87.10	54.86	<0.001*
Nurse role	25.1±6.7	26.80	95.0±4.7	97.60	54.58	<0.001*
General precautions	82.2±8.2	85.70	99.5±3.2	100.00	52.32	<0.001*
Cleaning/disinfecting endoscope	46.8±4.5	45.50	97.7±10.9	100.00	55.32	<0.001*

Total knowledge	37.5±2.3	38.70	92.5±3.4	93.10	52.28	<0.001*

Table 3. Nurses' practice scores regarding infection control precautions before, during and post esophageal varies endoscopy procedure throughout intervention (n=35)

Practice of:	Pre (n=35)		Post (n=35)		Mann Whitney Test	p-value
	Mean±SD	Median	Mean±SD	Median		
Patient preparation: Pre-procedure:						
General preparation	38.8±3.5	38.10	83.5±4.7	85.70	56.88	<0.001*
Specific preparation	37.1±22.2	50.00	85.7±22.9	100.00	39.34	<0.001*
During	36.3±4.0	38.50	90.5±3.8	92.30	57.53	<0.001*
Post	16.2±2.8	16.70	80.0±8.8	83.30	61.39	<0.001*
Documentation	0.0±0.0	0.00	54.9±8.9	60.00	62.98	<0.001*
Discharge	43.2±11.9	50.00	100.0±0.0	100.00	62.94	<0.001*
Total patient preparation	28.6±6.1	32.20	82.5±7.9	86.90	55.92	<0.001*
Pre-procedure infection control:						
Before:						
Wear overshoes	25.7±44.3	0.00	100.0±0.0	100.00	40.77	<0.001*
Wear mask/goggles	0.0±0.0	0.00	83.8±2.8	83.30	68.06	<0.001*
Wash hands	8.8±0.7	8.70	92.3±4.2	91.30	59.17	<0.001*
Wear sterile gown	2.3±4.0	0.00	87.5±8.6	81.80	57.34	<0.001*
Prepare/place equipment:						
Wear sterile gloves	0.0±0.0	0.00	91.4±5.9	87.50	62.29	<0.001*
During: Adhere to IC	2.9±16.90	0.00	100.0±0.0	100.00	65.17	<0.001*
Post:						
Pre-cleaning	12.3±4.3	10.00	100.0±0.0	100.00	63.41	<0.001*
Leakage testing	0.0±0.0	0.00	95.5±9.6	100.00	63.86	<0.001*
Manual cleaning	4.9±0.8	5.00	96.4±5.9	100.00	61.29	<0.001*
High level disinfection	0.5±2.8	0.00	99.5±2.8	100.00	67.14	<0.001*
Manual disinfection	0.9±5.1	0.00	100.0±0.0	100.00	68.06	<0.001*
Automated disinfection	0.0±0.00	0.00	100.0±0.0	100.00	69.00	<0.001*
Handling	0.0±0.00	0.00	100.0±0.0	100.00	69.00	<0.001*
Storage	79.0±13.4	83.30	100.0±0.0	100.00	57.09	<0.001*
Total IC	9.8±3.7	7.60	96.2±0.7	96.30	54.30	<0.001*
Total practice	24.4±1.1	24.90	92.7±2.4	93.70	52.34	<0.001*

The fourth portion of the results was concerned with the high numerical weighty relationship between the total knowledge (esophageal varices, endoscope, nurse role, general precautions and cleaning/disinfecting endoscope) and the total practice (patient preparation and infection control) in post program implementation phases p=0.897 (Table 4).

The fifth portion of the results was concerned with the lack of correlation coefficient between the knowledge and practice of the nurses and their demographic characteristics (age, experience and Experience (hematemesis unit)) pre and post program (Table 5).

The sixth portion of the results was concerned with the strong coefficient relation between the knowledge scores, excluding the age, qualification, job position, experience, training courses, vaccination, with r-square=0.99 (Table 6).

The seventh portion of the results demonstrated that there were strong coefficient relations between the practice scores and excluding the age, qualification, job position, experience, training courses, vaccination, with r-square=0.99 (Tables 7).

Table 4. Correlation between nurses' knowledge and practice scores (n= 35)

Knowledge of	Spearman's rank correlation coefficient		
	Practice		
	Patient preparation	Infection control	Total practice
Esophageal varices	.808**	.706**	.778**
Endoscope	.825**	.771**	.814**
Nurse role	.813**	.846**	.808**
General precautions	.857**	.688**	.910**

Cleaning/disinfecting endoscope	.780**	.821**	.812**
Total knowledge	.875**	.723**	.897**

(**) Statistically significant at p<0.01

Table 5. Correlation between nurses' knowledge and practice scores and their characteristics (n=35)

	Spearman's rank correlation coefficient	
	Knowledge scores	Practice scores
Age	-.033	-.013
Qualification	.063	.148
Experience (total)	-.052	-.073
Experience (hematemesis unit)	-.050	-.060
Experience (endoscopy unit)	.034	-.047

r-square=0.99 Model ANOVA: F=6176.61, p<0.001

Variables were entered and the age, qualification, job position, experience, training courses, vaccination were excluded.

Table 6. Best fitting multiple linear regression model for the knowledge score (n=35)

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	-17.52	1.11		15.835	<0.001	-19.73	-15.31
Intervention	54.99	0.70	0.99	78.591	<0.001	53.60	56.39

r-square=0.99 Model ANOVA: F=6176.61, p<0.001

Variables were entered, and the age, qualification, job position, experience, training courses, vaccination were excluded.

Table 7. Best fitting multiple linear regression model for the practice score

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	-42.97	1.79		23.968	<0.001	-46.55	-39.39
Intervention	55.24	3.54	0.81	15.585	<0.001	48.16	62.32
Age	0.20	0.05	0.06	3.637	0.001	0.09	0.31
Total experience	-0.25	0.06	-0.07	-3.971	<0.001	-0.37	-0.12
Knowledge score	0.24	0.06	0.19	3.705	<0.001	0.11	0.37

r-square=0.99 Model ANOVA: F=8733.17, p<0.001

Variables were entered and the qualification, job position, experience in units, training courses, vaccination were excluded.

DISCUSSION

Gastrointestinal (GI) endoscopy is an essential tool for the identification and treatment of esophageal varices [9, 10]. Esophageal varices could cause shock, various infections like pneumonia, peritonitis, and bloodstream infection when left untreated. Patients and their physicians should be vigilant [4]. Over 50% of the patients have been hospitalized due to esophageal varices that can be diagnosed with an infection [5]. The rate of mortality in patients with esophageal varices is high about 20-35 %.

All staff in any situation where gastrointestinal endoscopy is accomplished must involve in the infection control principles that will maintain a safe environment, free from the possibility of spreading disease to patients and co-workers. This is accurate nevertheless of the setting (hospital, clinic, ambulatory care center and office), related to all kinds of gastrointestinal (GI) processes accomplished by SGNA [11, 12].

Nosocomial infection has many adverse effects on both patients and health care workers, it represents an undue economic burden, which increases the costs, the hospitalization rate and the need for the antimicrobial medications, and increases the morbidity, and mortality significantly [13].

The danger of infection after the upper gastrointestinal (GI) tract endoscopy has been found to be infrequent ; however, the invasive endoscopic procedures can lead to various complications including the remote bacterial infection [14].

Discussion of the results include four main areas in the following sequence: First, the demographic characteristics of the studied nurses; Second, the nurses' knowledge regarding esophageal Versace and the role of nurses pre, during and post endoscopy; Third, nurses' practices regarding infection control precaution and Endoscopy disinfection; fourth, the correlation between different variables.

Demographic characteristics of the current study indicated that the 60 % of the nurses were in the age range of less than 40 years with the mean age of 38.7 ± 10.7 years. Regarding nursing qualification, 88.6% of the studed nurses had Diploma in nursing, while 11.4% had Bachelor in Nursing. As well, 54.3% of the study nurses had less than 10 years of experience in hematemesis unit with the mean±SD of 7.6±5.7years. Considering the attended training courses, 51.4% of them had received training. Regarding hepatitis B vaccination, 97.1% of the study's nurses received the vaccine.

The current study was performed on 35 nurses employed in endoscopy units in zagazig university hospitals.

This was in agreement with [15] who assessed the effectiveness of structured teaching programme regarding the knowledge on Nosocomial infections in newborns among the staff nurses working in labour and paediatric units of the selected Hospitals in Tumkur District, and pointed that 78.33% of the staff nurses were females and 21.66% of them were aged between 21-30 years. Considering the experience categories, 21.66 of the staff nurses had 0-5 year of experience. The same finding was reported by [16], who studied the effectiveness of teaching the infection control practices among the health care professionals in the various general wards, including private and semi private wards, and intensive care units of a tertiary care hospital in Pune, and reported that the majority of the participants including 91.59% were female nurses, who were less than 25 years of age, 56.30% were having less than one-year experience, while 30.25% were B.Sc. [17] in Egypt studied the effect of implementing a control action plan for the nfection prevention at endoscopy unit, and reported that 66.7% of the nurses were < 30 years old and 33.3% were from 30 to < 40 years old . In addition, a study carried out in Zagazig University by [18] stated that the mean age of nurses was 29.5± 5.76. The most of nurses' age (62%) was less than 30 years, and most of the subjects were female. That agreed with [9] conducted a study in Endoscopy Units in Elnaser Insurance Hospital, on 35 nurses working in the unit.

The current study indicated that, there was a highly statistical improvement in the knowledge of nurses on endoscopy, and the Mean±SD (2.4±0.8) pre nursing intervention increased to the (Mean±SD) 8.8±0.4 post nursing intervention, during endoscopy, the Mean±SD (2.8±0.4) pre nursing intervention increased to the Mean±SD (7.8±0.4) post nurses intervention, after endoscopy, the Mean±SD (2.1±1.1) pre nursing intervention increased to the Mean±SD (8.7±0.9) post nursing intervention,showing that, there was a highly statistical significant level of nurses' knowledge regarding the nursing instructions, the Mean±SD (1.1±0.5) pre nursing intervention increased to the Mean±SD (5.8±0.7) post nursing intervention, the Mean±SD (1.9±1.1) of emergency cases pre nursing intervention increased to the Mean±SD (6.9±0.6) post nursing intervention, and the Mean±SD (0.0±0.0) of the written precautions pre nursing intervention increased to the Mean±SD (1.0±0.2) post nursing intervention at ($p \leq 0.001$).

This finding was in concordance with [18] who indicated that there were highly significance differences between the phases of study regarding the knowledge and practice of universal precautions and endoscopic reprocessing between Pre & Post, Pre & follow up (P=0.0001) among the studied nurses. In addition, a study was carried out in India by [19] who assessed the posttest and pretest knowledge scores of staff nurses regarding the infection control measures which were found to be highly significant ($p<0.05$).

On the same line with this finding was a study done by [20] who pointed that the mean of the overall knowledge was 699, and the mean percentage was 93%, which were higher than the mean value of 319 and the mean percentage of 51% in the pretest. As well, [16] reported that there was a highly significant difference in the overall knowledge & practice of the infection control protocols among the nurses during the posttest showing that the overall effect of the training was good. In this regards, a study was carried out in Egypt 2010 [17] which demonstrated that there was a significant difference between the pretest and posttest considering the total knowledge score of nurses about on the infection prevention and control ($p < 0.001$). The mean of the total score of nurses' knowledge in posttest was higher than the pretest. This indicated that the improvement of the knowledge of nurses after the action plan was observed. There was a statistical significant difference between pre, and post intervention regarding the universal

precaution measures and endoscope reprocessing among the nurses except for wearing gloves and eye goggles. This indicated that the implementation of the action plan was very effective in enhancing the physicians and nurses' knowledge and practice regarding wearing personal protective equipment.

The finding was in agreement with [18] who demonstrated that 7.5% of the nurses had satisfactory knowledge before the implementation of the infection control training program, 75.0% of them after the program implementation and 67.5% after 6 months of the program implementation (follow-up). In addition, more than half of nurses (85.0%) had an unsatisfactory level of the practice in the pre infection control training program, (82.5%) of them in the post program had a satisfactory practice and persisted in the follow-up, (77.5%) of the nurses had a high level of practice ($p > 0.0001$). As well, [21] demonstrated that 4.4% subjects had poor knowledge, 46.6% subjects had average knowledge, 48.8% of the subjects had good knowledge and none of the subjects had very good knowledge. In the posttest, 65.5% of the subjects gained very good level of knowledge, 33.3% of the subjects gained a good level of knowledge,1.1% of the subjects gained the average level of knowledge, while none had poor knowledge regarding the infection control.

The present study revealed that there was a high significant improvement in the practice of nurses in the patient preparation: Pre-procedure: the Mean±SD (28.6±6.1) of the total patient preparation pre nursing intervention increased to the Mean±SD (82.5±7.9) post nursing intervention ; Pre-procedure infection control: before the procedure the Mean±SD (25.7±44.3) of wearing overshoes pre nursing intervention increased to the Mean±SD (100.0±0.0) post nursing intervention, the Mean±SD (0.0±0.0) of wearing mask/goggles pre nursing intervention increased to the Mean±SD (83.8±2.8) post nursing intervention, the Mean±SD (8.8±0.7) of washing hands pre nursing intervention increased to the Mean±SD (92.3±4.2) post nursing intervention, the Mean±SD (2.3±4.0) of wearing sterile gown pre nursing intervention increased to the Mean±SD (87.5±8.6) post nursing intervention ; The equipment: the Mean±SD (0.0±0.0) of wearing sterile gloves pre nursing intervention increased to the Mean±SD (91.4±5.9) post nursing intervention, during: the Mean±SD (2.9±16.90) of adherence to IC infection control pre nursing intervention increased to the Mean±SD (100.0±0.0) post nursing intervention : Post procedure: the Mean±SD (9.8±3.7) of the total infection control pre nursing intervention increased to the Mean±SD (96.2±0.7) post nursing intervention, the Mean±SD (24.4±1.1) of the total practice pre nursing intervention increased to the Mean±SD 92.7±2.4 post nursing intervention, at ($p \leq 0.001$).

The obtained data were in agreement with [16] who studied the effectiveness of teaching on infection control practices among the health care professionals, and revealed that there was a highly significant difference in the overall knowledge and practice of the infection control protocols among the nurses during the posttest showing that the overall effect of training was good.

The results were in agreement with [22] who examined the features of educational interventions that lead to the compliance with hand hygiene in healthcare professionals within the hospital care setting, and mentioned that 30 percent of all health care associated infections (HCAI) are potentially preventable by the better application of the knowledge and adherence to the infection prevention procedures. The implementation of the department of health procedures through the educational involvements has resulted in noteworthy and continued enhancements in hand hygiene compliance and reductions in HCAI. Lack of knowledge was a factor that could have a negative effect on the hand washing practices. The researchers have examined the knowledge of the healthcare workers prior to implementing an intervention program, such as [23] who mentioned the hand hygiene practices & [24] who mentioned the health care workers' hand decontamination, and they reported deficits concerning the quality of hand washing, hand cleansing and glove use indications, risks associated with the noncompliance to the published guidelines.

The findings disagreed with [25] who conducted a study in Ain-Shams University, and revealed the sources of infection in the intensive care units and suggested a control system, they also indicated that in the high institute of nursing, nearly all of the studied nurses reported correct answers concerning the time of hand washing. In addition, in a study carried by [26] in Zagazig University Hospital, to assess the nurses' knowledge and practices related to the nosocomial infection control measures at the intensive care units, all nurses reported correct answers concerning the items related to the time of hand washing. Moreover, another study carried by [27] in Zagazig University, mentioned the designing , implementing, and evaluating an educational program to prevent the infection in the burn unit, and [28] in Zagazig University who assessed the nurses' knowledge and practice of infection control precautions, concluded that the majority of nurses reported that hand washing practices are very important before and after contacting the patients, and it was considered as the single and most significant way of avoiding infections.

These results were congruent with [29], who studided the impact of universal infection control intervention program on nurses at Asser Hospital Medical-Surgical Nursing Department, Faculty of Nursing, regarding the nurses' knowledge related to gowns or aprons, and it was revealed that more than 50 % of the nurses had adequate knowledge before the program application.

In relation to the precautions with sharp disposal and blood splash on mucous membrane, the current study represented that more than two fifth of the nurses had knowledge pre implantation ; more than two third in post, and the majority including two third in follow up. In the same line with these findings, [30] in Zagazig University, assessed the effect of the implemented infection control program on the nurses in Zagazig Fever Hospital, and revealed that the majority of the studied nurses had correct answers related to the safe sharp disposal.

In the same line, [18] in Elnaser Insurance Hospital at Helwan City in Egypt, who studied the effect of infection control training programs on the performance and microbial results in GIT endoscopes, and they stated that, it was quite anticipated to find very low levels of knowledge among the nurses in the study before the implementation of the program. This was found in all the tested areas of knowledge identical (wearing protective clothes, transferring endoscope for cleaning, pre-manual cleaning stage, test leak, manual cleaning stage, rinsing, sterilization and dryness, dangerous of inadequate endoscope disinfection, storage, and documentation)

This study showed that there was no statistically significant relation between the improvement of knowledge and socio-demographic characteristics of the studied subjects in endoscopy unit in pre, post, and follow up implementation phases of the educational program regarding the infection. Similar findings were revealed by the study done by [31], in Benha university, to study the impact of the intended infection control training program on the knowledge and practice of the nurses, and revealed that, there was no noteworthy relationship between the nurses' knowledge of the infection control measures and the practice of the nurses pre-program, immediately post program, after one and two months of the program application.

On the other hand, [32] in Benha University studied the effect of the designed implemented nurses' educational program on minimizing the incidence of the complications in patients with the upper gastrointestinal bleeding, and indicated that, there were weighty enhancements in the studied nurses' knowledge and practice after the program implementation. In addition, [33] in Egypt, evaluated an isolation program of hepatitis C virus in the infected hemodialysis patients in some hemodialysis centers, and revealed that, there were statistical significant differences ($p<0.01$) between the improvement of the nurses' practice and the implementation of the infection control program. In the same line, [34] in Benha University reported that the quality of nurses' performance to provide client satisfaction in kidney dialysis was improved, and a significant (+) correlation between the enhancement of the knowledge and the upgrading of the practice in the post program was reported.

The results of the present study showed that there was no statistically significant difference in the total nurses' practice in relation to the demographic characteristics in pre, post program implementation phases. The previous finding were in agreement with [31], that investigated the impact of designed infection control training program on the nurses' knowledge and practice at Benha university hospital, the results revealed that, there was no important correlation between nurses' knowledge of infection control measures, their age, years of experience pre and post program implementation. Also, [35] in Ain-shams University, Egypt, found the medication administration errors among nurses, and [36] in Benha University Hospital, investigated the patients with the ventilator associated pneumonia, to find out the impact of designed training program on the nurses' knowledge and practice, and on the patients' outcomes at the intensive care unit, and revealed that there was no noteworthy correlation between the nurses' knowledge and their experiences.

On the other hand, results of the current study revealed that these findings contradicted with [37] which indicated that neither age nor qualification, occupation and years of experience consistently proved to be a powerful predictor of the nurses' responses.

This research represented that there was no relationship between the enhancement of knowledge and development of practice of the study subject. This disagreed with [38] who studied the effect of an educational program on nurses' knowledge and practice related to hepatitis C virus, and revealed that, there was a positive statistically correlation p-value <0.01 between the nurses' practice score and knowledge score pre and post implementation of nosocomial IC program.

On the other hand, there was numerical weighty (+) relation found between the knowledge and practice [39], the knowledge and behaviour of nurse/midwives in the prevention of vertical transmission of HIV in Owerri, Imo State, Nigeria [40], the knowledge of blood-borne infectious diseases and the practice of universal precautions amongst the

health-care workers in a tertiary hospital in Malaysia [41], the intensive care nurses' knowledge & practices , that revealed that, there has been statistically significant positive correlation between the knowledge and practice of the universal precautions.

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