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Effect of Nursing Intervention Protocol on the Incidence of Catheter Associated Urinary Tract Infection among Critically Ill Patients

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Abstract: **Urinary tract infections are the most common healthcare-associated infections, and are especially common among patients in the intensive care unit. A majority of nosocomial urinary tract infections is related to insertion of urinary catheters. Aim: The aim of the present study is to determine the effect of nursing intervention protocol on the incidence of catheter associated urinary tract infection among critically ill patients. Design: Quasi-experimental research design was utilized in the study. Sample: A purposive sample of (70) adult patients from both genders were required for indwelling urinary catheter. Setting: Data were collected from General Intensive Care Units at Ain Shams University Hospitals. Tools: Two tools were used for data collection (I) A structured interview assessment questionnaire, which included (a) Socio Demographic and Medical Characteristics Assessment sheet, (b) Urinary Catheter Assessment Sheet, (II) Catheter Associated Urinary Tract Infection Checklist Tool, which included (a) Urinary Tract Infection Manifestations, (b) Mechanical problems, and (c) Diagnostic studies. Results: This study revealed that, there was a statistically significant difference in occurrence of Catheter associated urinary tract infections between study and control group in which study group showed lower incidence of Catheter associated urinary tract infections than control group. Conclusion: Applying of nursing intervention protocol by using sterile technique during catheter insertion and maintain daily care for the catheter after insertion decrease the incidence of Catheter associated urinary tract infections. Recommendation: The study recommended that; an educational guidelines and training on insertion of a urinary catheter by using sterile technique and maintain daily care for the catheter after insertion should be held for Intensive Care Unit nurses to decrease the incidence of Catheter associated urinary tract infections.**

Keywords: **Catheter associated urinary tract infections – critically ill patients - nursing intervention protocol.**

1. INTRODUCTION

Urinary tract infections (UTIs) are caused by pathogenic microorganisms in the urinary tract. UTIs are generally classified as infections involving the upper and lower urinary tract. Upper UTIs are much less common and includes acute or chronic pyelonephritis, interstitial nephritis, and renal abscesses. Lower UTIs includes bacterial cystitis, bacterial prostatitis, and bacterial urethritis **Smeltzer, Bare, Hinkle, and Cheever, (2014)**.

Most urinary tract infections follow instrumentation of the urinary tract, usually catheterization. The pathogens that cause catheter-associated urinary tract infection (CAUTI) includes Escherichia Coli, Klebsiella, Proteus, Pseudomonas, Enterobacter, Serratia, and Candida species. Many of these organisms are part of the patient's endogenous or normal bowel flora, are acquired through cross-contamination by patients and health care personnel, or through exposure to non-sterile equipment **Smeltzer et al. (2014)**.

The risk of bacteriuria increases by5-8% per day of indwelling catheters. The majority of micro-organisms derive from the patient's own colonic and perineal flora or from the hands of healthcare personnel during catheter insertion or management. Catheter surfaces become rapidly colonized by a layer of infecting micro-organisms embedded in a matrix of host proteins and microbial exopolysaccharides forming a strongly adherent biofilm **Rosenthal, Rodriguez-Ferrer, Singhal, Pawar, Berba et al. (2012).**

Several studies have focused on strategies to limit the use and duration of urinary catheters in an effort to decrease CAUTI rates. The most effective strategies described are reminder systems to reassess the need for a urinary catheter. The majority of reminder systems studied to date has used non computerized reminders, such as written reminders, stickers, prewritten orders, and nurse-generated reminders **Umscheid, Mitchell, Doshi, Agarwal, Williams et al. (2011).**

The prevention of CAUTI is an important opportunity for nurse leaders to engage clinical nurses in meaningful improvement efforts. Clinical nurses are best positioned to examine urinary catheter insertion workflow and to suggest improvements in avoiding use and improving placement and maintenance. To engage clinical nurses in CAUTI prevention, nurse leaders should focus on how urinary catheters expose patients to potential harm, involve nurses in designing and implementing practice changes, and provide local data to show the impact of nursing practices on patient outcomes **Carter, Pallin, Mandel, Sinnette, and Schuur (2016)**.

Key guidelines for prevention of catheter-associated urinary tract infection include placement of indwelling urinary catheters for appropriate indications, using alternatives to indwelling catheterization, using aseptic technique during insertion, and early removal of indwelling catheters. Catheter associated urinary tract infection prevention guidelines can reduce catheter associated urinary tract infection rates by 53% **Meddings, Rogers, Krein, Fakih, Olmsted et al. (2013).**

Significance of the study:

Use of Evidence-Based Practice guidelines within health care facilities has been shown to significantly reduce the number of catheter-associated urinary tract infection. However, despite the use of these guidelines, over 900,000 patients develop a catheter-associated urinary tract infection in the United States every year **Modica, Raja, Quinones, Diongon, and Figueredo, (2014).**

CAUTI surveillance was conducted in 4 ICU at Alexandria University Hospital during the 1-year surveillance study period; the result revealed that 518 patients had catheters inserted during their ICU stay. And 161 catheter-associated infections; 105 symptomatic and 56 asymptomatic catheters associated urinary tract infection occurred during the surveillance period. Rates of CAUTI ranged from 7.3 to 23.6 per 1000 catheter-days in the 4 ICU; the overall rate was15.7 infections per 1000 catheter-days **Talaat, Hafez, Saied, Elfeky, El-Shoubary et al. (2010).**

The main reason of CAUTIs is the widespread use of indwelling catheters, and one in 333 indwelling urinary catheters will cause infection. In addition, between 21% and 63% of indwelling urinary catheters are placed in patients without appropriate clinical indication **Knudson, (2014).**

Aim of the study:

The aim of the present study is to determine the effect of nursing intervention protocol on the incidence of catheter associated urinary tract infection among critically ill patients through the following objectives:-

- Assess patient's urinary tract status and its related variables.
- Modify the standardized nursing intervention protocol based on the basic assessed needs.
- Implement the nursing intervention protocol for the study group.
- Evaluate the effect of applying the nursing intervention protocol on the incidence of Catheter Associated Urinary Tract Infections on the study group.

Research Hypotheses:

At the end of the study, Patients who will receive the nursing intervention protocol will have low incidence rate of catheter associated urinary tract infection than patients who will not receive the nursing intervention protocol as measured by tool II.

Operational definition:

Nursing intervention protocol:

It is a nursing intervention protocol for urinary catheter insertion and daily care of it. Which adopted by the investigator that will be applied to the study group which include the following; determine the indication of catheterization,, selecting appropriate catheter and drainage system, applying aseptic technique during insertion f the suitable catheter, securing catheter to prevent movement , maintaining closed drainage system and frequently inspecting urine characteristics. The effect of this nursing intervention protocol will be measured by tool II.

2. SUBJECTS AND METHODS

Design:

A Quasi-experimental research design was utilized in this study.

Participants:

A purposive sample of 70 adult patients from both genders required for indwelling urinary catheter at General Intensive Care Units at Ain Shams University Hospitals.

Research tools:

I. Tool (I): Structured Interview Assessment Questionnaire; which adopted from **Gomaa, (2011)** and modified by the investigator after reviewing the most recent and relevant literature. It was filled by the investigator and consists of two parts.

I.1- The first part concerning with patient's socio-demographic and medical characteristics; which composed of (15) closed ended question includes the following; age, gender, marital status, educational level, occupation, medical diagnosis, level of consciousness, level of mobility, past medical history that includes previous hospitalization, previous bladder catheterization, as well as previously UTI, and present medical history that includes method of feeding, bowel elimination, history of comorbidities disease, and receiving prophylactic antibiotics.

I.2- The second part concerning with urinary catheter assessment sheet; which composed of (8) closed ended question includes the following; reason for catheterization, size of the catheter, type of the catheter, type of catheter material, frequency of catheter change, reason of catheter change, complication occurs during and/or after catheter insertion, and what is the type of this complication.

II. Tool (II): Catheter Associated Urinary Tract Infection Checklist Tool; which adopted from **Gomaa, (2011)** and modified by the investigator after reviewing the most recent and relevant literature. It was filled by the investigator to assess signs & symptoms of catheter associated urinary tract infection which include the following three parts.

II.1- The first part concerning with urinary tract infection manifestation; which used to assess UTI manifestation, it consists of 4 items as a general manifestation includes fever, tachycardia, chills, malaise and 4 items as a local manifestation includes urethral discharge, redness of perineal area, irritation, and change in urine characteristics (color, odor, and consistency).

II.2-The second part concerning with mechanical problems; this used to assess mechanical problems as leakage, blockage, bladder distention, local abscess, and urethral stricture.

II.3-The third part concerning with diagnostic studies; which consisting of 5 laboratory tests such as hemoglobin, serum leukocyte count, serum creatinine, urine analysis and urine culture.

A scoring system for tool II: Catheter Associated Urinary Tract Infection Checklist Tool was scored as the following: Present = 1 grade and Not present = zero.

Content validity and reliability:

The tools were revised by jury of 5 experts as the following; 2 Lecturers of medical surgical nursing from faculty of nursing, Helwan University, professor of medical surgical nursing from faculty of nursing, Zagazig University, lecturer of medical surgical nursing from faculty of nursing, Beni Suif University, and professor of internal medicine from faculty of

medicine, Helwan University, who reviewed the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability. Minor modifications were done**.** Reliability of tools of the present study was (cronbach's alpha (0.809), acceptable).

Pilot study:

A Pilot study was carried out with 10% (not less than 10 patients) of the sample under study to test the applicability, clarity and efficiency of the tools, then the tools modified according to the results of a pilot study, patients whom shared in pilot study not included in the sample and replaced by other patients.

Field work:

After obtaining the official permissions, the investigator started to recruit the sample of patients. The purpose of the study was simply explained to the patients or to their families who agree to participate in the study prior to any data collection. Sampling was started and completed within eight months from April (2017) until the end of November (2017). Data collection was done by the investigator in the morning and afternoon shifts before and after catheter insertion. Tool (I): Structured Interview Assessment Questionnaire was filled for the study and control group by the investigator before catheter insertion and some items was filled immediately after catheter insertion. Tool (II): Catheter Associated Urinary Tract Infection Checklist Tool was filled daily for 7days following catheter insertion by the investigator.

Ethical considerations:

An approval was obtained from a scientific research ethics committee of the faculty of nursing at Helwan University and a written informed consent was obtained from the study subjects individually before starting the study. The aim and objectives of the study was clarified to the patients included in the study by the investigator. Participants will be assured that anonymity and confidentiality would guarantee. Patients will be informed that they are allowed to choose to participate or withdraw from the study at any time. Ethics, culture, values will be respected.

Statistical analysis:

Qualitative data were presented as frequencies (n) and percentages (%). Chi-square test (or Fissure's Exact test when applicable) were used for comparisons between the two groups. McNemar's test was used to study the change at the end of treatment for binary variables. Friedman's test and Wilcoxon signed-rank test was used to study the change at the end of treatment for other qualitative variables. Numerical data were presented as mean, median, standard deviation (SD) and range values. Student's t-test was used to compare between mean age values in the two groups. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with "IBM-SPSS" Statistics Version 20 for Windows.

3. RESULTS

Table (1): shows that there was no statistically significant difference between socio-demographic characteristics of the two groups regarding gender (*P*-value = 0.631), mean age (*P*-value = 0.140), age categories (*P*-value = 0.270), social status (*P*-value = 0.512), education (*P*-value = 0.938) as well as occupation (*P*-value = 0.342). In the study group; 51.4% of the patients were males, 48.6% were females with mean and standard deviation values of age 45.1± 13.3 years old. 68.6% of the patients were married, 17.1% were widowed. About One quarter of the patients (25.7%) had secondary education, 22.9% can read and write, 20% were illiterate, and 17.1% had preparatory education while 14.3% were university graduates. As regards occupation; 42.9% were worker, 34.3% were house wife while 22.9% were not working.

For the control group; 57.1% of the patients were males, 42.9% were females with mean and standard deviation values of age 49.3± 10.3 years old. 54.3% of the patients were married, 17.1% were widowed, 14.3% were single and 14.3% also were divorced. One quarter of the patients (25.7%) were illiterate, 22.9% had secondary education, also 22.9% can read and write, 17.1% were university graduates while 11.4% had preparatory education. As regards occupation; 45.7% were worker, 34.3% were not working while 20% were house wife.

Table (2): shows that there was no statistically significant difference between the two groups regarding medical diagnosis that include, heart disease (*P*-value = 0.255), liver disease (*P*-value = 1.000), respiratory disease (*P*-value = 0.403) as well as neurological disease (*P*-value = 0.337). Neurological diseases were the common medical diagnosis for the patients of the study group (51.4%) as well as for the patients of the control group (40%). As regards the levels of consciousness and mobility, there was also no statistically significant difference between the two groups (*P*-value = 0.056 and 0.093, respectively).

There was no statistically significant difference between the two groups regarding previous hospitalization and previous bladder catheterization (*P*-value 0.799, 0.771 respectively).There was no statistically significant difference between prevalence of previous UTI in the two groups (*P*-value = 1.000). Only (2) cases in study group and (2) cases also in control group had previous UTI. There was no statistically significant difference between the two groups regarding feeding methods and bowel elimination (*P*-value = 0.906, 0.280 respectively). In the study groups; about half of the patients (45.7%) were with oral feeding, while (8.6%) were with both enteral and parenteral feeding. Majority of the patients (91.4%) had normal bowel elimination. In the control groups; more than one third of the patients (40%) were with oral feeding, (37.1%) were with enteral feeding, while minority of them (11.4%) were with both enteral and parenteral feeding, also (11.4%) were with only parenteral feeding. More than three quadrants of the patients (77.1%) had normal bowel elimination.There was no statistically significant difference between prevalence of comorbidities in the two groups (*P*-value = 0.555). Study group showed higher prevalence of hypertension, and neurological diseases while control group showed higher prevalence of heart diseases, hypertension, and neurological diseases.

Table (3): shows that there was no statistically significant difference between catheter assessments criteria in the two groups through the whole follow up period. In the study group; As regards reason for catheterization, more than half of the patients (62.9%) were catheterized due to measure urine output, (54.3%) were catheterized for limited mobility, (8.6%) were catheterized due to incontinence, while no patients catheterized for urinary retention. About half of the patients (48.6%) catheterized with size 16 Fr, and another half of the patients (51.4%) catheterized with size 18 Fr. Only five patients (14.3%) catheter changed once for them due to leakage (two patients), pull-out (two patients), and only (one patient) due to blockage.

As regards complications during or after insertion; only six patients (17.1%) complication occurred with them as the following; difficult insertion (three patients) and bleeding (three patients).In the control group; As regards reason for catheterization, about two thirds of the patients (68.6%) were catheterized due to measure urine output, (54.3%) were catheterized for limited mobility, (17.1%) were catheterized due to incontinence, while (14.3%) were catheterized for urinary retention. More than half of the patients (54.3%) catheterized with size 16 Fr, (40%) catheterized with size 18 Fr, and only (5.7%) catheterized with 14 Fr. Catheter changed once in nine patients of them (25.7%) due to leakage (five patients), blockage (three patient), and pull-out (only one patients).As regards complications during or after insertion; only five patients (14.3%) complication occurred with them as the following; difficult insertion (three patients), bleeding (only one patient), and trauma of urethra (only one patient also).

Table (4): shows that there was no statistically significant difference between Hemoglobin levels in the two groups whether on admission or after week (*P*-value = 0.225 and 0.179, respectively).As regards serum leucocytic count; there was no statistically significant difference between the two groups on admission (*P*-value = 0.167).Also there was no statistically significant difference between the two groups regarding serum creatinine on admission (*P*-value = 0.259).

Figure (1): showed that, the study group showed higher prevalence of patients with normal count than the control group.

Figure (2): showed that, the study group showed higher prevalence of patients with normal serum creatinine than the control group.

Table (5): showed that; as regard to urine color, there was no statistically significant difference between the two groups whether on admission or after week (*P*-value = 0.239 and 0.434, respectively).Also, there was no statistically significant difference between the two groups regarding pus cells on admission (*P*-value = 0.614).

Figure (3): showed that, the study group showed higher prevalence of patients with pus cells <10 cells/HPF than control group.

Table (6): showed that; the study group showed higher prevalence of patients with no colony counts (sterile) than control group with (*P*-value = 0.045).However, there was no statistically significant difference between types of microorganisms in the two groups (P-value = 0.826).

Table(7): shows that there was no statistically significant association between reasons for catheterization whether to measure urine output, urinary retention, limited mobility or urinary incontinence and prevalence of UTI (P-Value 0.802, 0.825, 0.118, 1.000 respectively).

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There was no statistically significant association between size of catheter, complication of insertion and prevalence of UTI (P-value 0.491, 0.191 respectively), While there was a statistically significant association between the frequency of catheter change and prevalence of UTI (P-Value0.012). Changing the catheter once for any cause as leakage, blockage or Pull-out was associated with prevalence of UTI.

Table (8): shows that, there was no statistically significant association between hemoglobin at the end of the study period(after week) and prevalence of UTI (P-value 0.065). There was a statistically significant association between creatinine and leukocytes at the end of the study period (after week) and prevalence of UTI (P-value0.004, 0.000 respectively). Prevalence of UTI was associated with increased creatinine and leukocytes than normal level.

Table (1): Descriptive statistics for both study and control group regarding Socio- demographic characteristics.

Items	Study (n = 35)	Control (n = 35)	Test statistic	*P*-value
Age /years				
Mean ± SD	45.1 ± 13.3	49.3 ± 10.3	t = -1.492	0.140
Median	48	50		
Range	20 – 64	20 – 63		
Age category [n (%)]				
20 – 35 y	9 (25.7%)	4 (11.4%)	x^2 = 2.620	0.270
36 – 50 y	10 (28.6%)	14 (40%)		
51 – 65 y	16 (45.7%)	17 (48.6%)		
Gender [n (%)]				
Male	18 (51.4%)	20 (57.1%)	x^2 = 0.230	0.631
Female	17 (48.6%)	15 (42.9%)		
Social status [n (%)]				
Single	3 (8.6%)	5 (14.3%)	*Fisher's Exact test* = 2.342	0.512
Married	24 (68.6%)	19 (54.3%)		
Divorced	2 (5.7%)	5 (14.3%)		
Widowed	6 (17.1%)	6 (17.1%)		
Education [n (%)]				
Illiterate	7 (20%)	9 (25.7%)	x^2 = 0.800	0.938
Can read and write	8 (22.9%)	8 (22.9%)		
Preparatory	6 (17.1%)	4 (11.4%)		
Secondary	9 (25.7%)	8 (22.9%)		
University / Higher	5 (14.3%)	6 (17.1%)		
Occupation [n (%)]				
Worker	15 (42.9%)	16 (45.7%)	x^2 = 2.148	0.342
Unemployed	8 (22.9%)	12 (34.3%)		
Housewife	12 (34.3%)	7 (20%)		

**: Significant at P ≤ 0.05*

Table (2): Descriptive statistics for both study and control group regarding medical history.

Items	Study (n = 35)		Control (n = 35)		Test statistic	*P*-value
	N	%	N	%		
Medical diagnosis						
Heart disease	6	17.1	10	28.6	x^2 = 1.296	0.255
Liver disease	5	14.3	5	14.3	x^2 = 0.000	1.000
Respiratory disease	7	20	10	28.6	x^2 = 0.699	0.403
Neurological disease	18	51.4	14	40	x^2 = 0.921	0.337
Level of consciousness						
Conscious	22	62.9	14	40	x^2 = 3.660	0.056
Unconscious	13	37.1	21	60		
Level of mobility						
Mobile	11	31.4	7	20	x^2 = 4.745	0.093

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Immobile Mobile with assistance	14 10	40 28.6	23 5	65.7 14.3		
Previous hospitalization	11	31.4	12	34.3	$x^2 = 0.065$	0.799
Previous bladder catheterization	7	20	8	22.9	$x^2 = 0.085$	0.771
Previous UTI	2	5.7	2	5.7	*Fisher's Exact test* = 0.000	1.000
Feeding method Oral Enteral Parenteral Enteral and parenteral	 16 11 5 3	 45.7 31.4 14.3 8.6	 14 13 4 4	 40 37.1 11.4 11.4	*Fisher's Exact test* = 0.671	0.906
Bowel elimination Normal Constipation Diarrhea	 32 2 1	 91.4 5.7 2.9	 27 5 3	 77.1 14.3 8.6	*Fisher's Exact test* = 2.571	0.280
Comorbidities Heart disease Hypertension Liver disease COPD Neurological disease	 7 8 5 1 10	 20 22.9 14.3 2.9 28.6	 8 8 5 5 8	 22.9 22.9 14.3 14.3 22.9	*Fisher's Exact test* = 4.073	0.555

**:Significant at $P \leq 0.05$*

Table (3): Descriptive statistics for both study and control group regarding catheter assessment sheet.

Assessment	Study (n = 35)		Control (n = 35)		Test statistic	*P*-value
	N	%	N	%		
Reason for catheterization Measure urine output	22	62.9	24	68.6	$x^2 = 0.254$	0.615
Urinary retention	0	0	5	14.3	*Fisher's Exact test* = 5.385	0.054
Limited mobility	19	54.3	19	54.3	$x^2 = 0.000$	1.000
Incontinence	3	8.6	6	17.1	*Fisher's Exact test* = 1.148	0.477
Size of catheter 14 Fr	0	0	2	5.7		
16 Fr	17	48.6	19	54.3	*Fisher's Exact test* = 2.244	1.000
18 Fr	18	51.4	14	40		
Frequency of catheter change No change	30	85.7	26	74.3	$x^2 = 1.429$	0.232
Once change	5	14.3	9	25.7		
Reason for change Blockage	1/5	20	3/9	33.3	*Fisher's Exact test* = 1.620	0.601
Leakage	2/5	40	5/9	55.6		
Pull-out	2/5	40	1/9	11.1		
Complications during or after insertion	6	17.1	5	14.3	$x^2 = 0.108$	0.743
Type of complication Difficult insertion	3/6	50	3/5	60		
Trauma of urethra	0/6	0	1/5	20	*Fisher's Exact test* = 1.840	0.545
Bleeding	3/6	50	1/5	20		

**: Significant at $P \leq 0.05$*

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Table (4): Comparison between the study and control group regarding blood tests.

Test	Study (n = 35)		Control (n = 35)		Test statistic	*P*-value
	N	%	N	%		
Hemoglobin (On admission)						
Normal	17	48.6	12	34.3	$x^2 = 1.472$	0.225
Less than normal	18	51.4	23	65.7		
Hemoglobin (After week)						
Normal	12	34.3	7	20	$x^2 = 1.806$	0.179
Less than normal	23	65.7	28	80		
S. Leukocytes (On admission)						
Normal	34	97.1	30	85.7	$x^2 = 3.583$	0.167
Less than 4000 C/mm	1	2.9	2	5.7		
More than 11000C/mm	0	0	3	8.6		
S. Creatinine (On admission)						
Normal	33	94.3	29	82.9	*Fisher's Exact test* = 2.258	0.259
More than normal	2	5.7	6	17.1		

**: Significant at P ≤ 0.05*

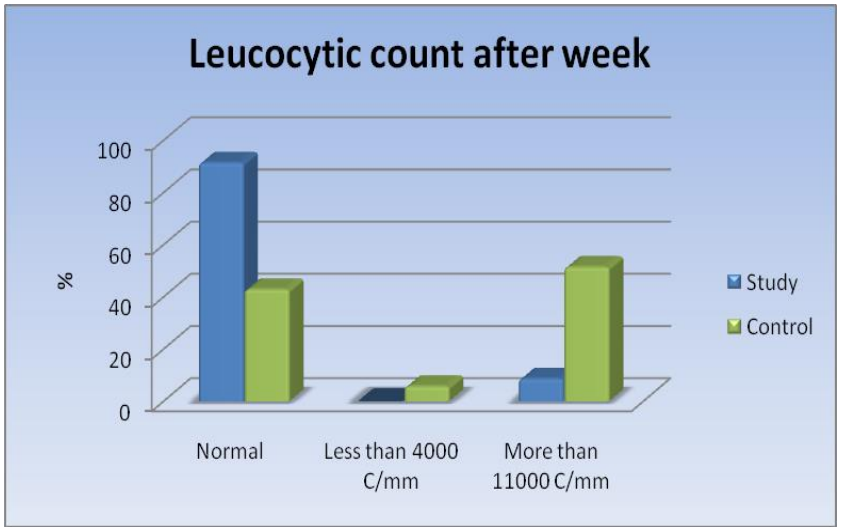

Figure (1): Bar chart representing leucocytes counts after week in the two groups with (p-value<0.001) .

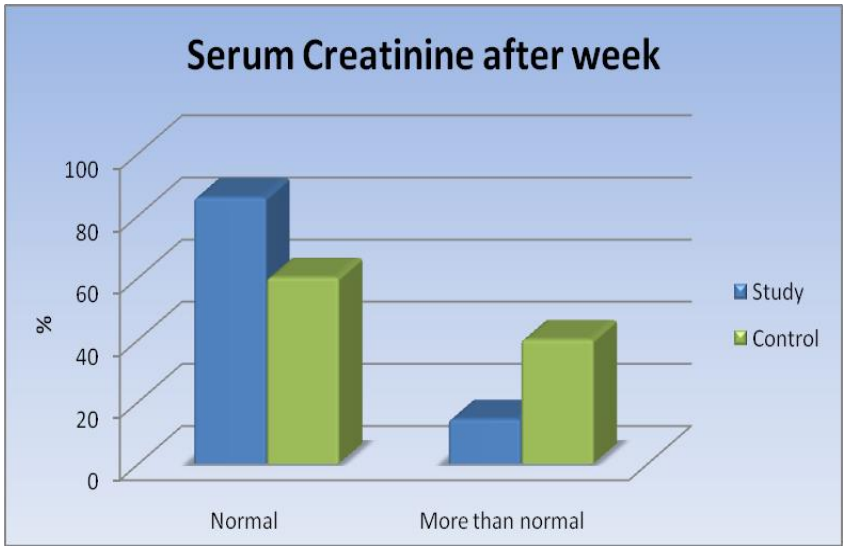

Figure (2): Bar chart representing serum creatinine after week in the two groups with(p-value=0.016).

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Table (5): Comparison between the study and control group regarding urine analysis.

Test	Study (N = 35)		Control (N = 35)		Test statistic	*P*-value
	N	%	N	%		
Color (On admission)						
Normal	32	91.4	35	100	*Fisher's Exact test* = 3.134	0.239
Abnormal	3	8.6	0	0		
Color (After week)						
Normal	26	74.3	23	65.7	x^2 = 0.612	0.434
Abnormal	9	25.7	12	34.3		
Pus cells (On admission)						
<10 cells/HPF	32	91.4	34	97.1	*Fisher's Exact test* = 1.061	0.614
>10 cells/HPF	3	8.6	1	2.9		

** Significant at $P \leq 0.05$*

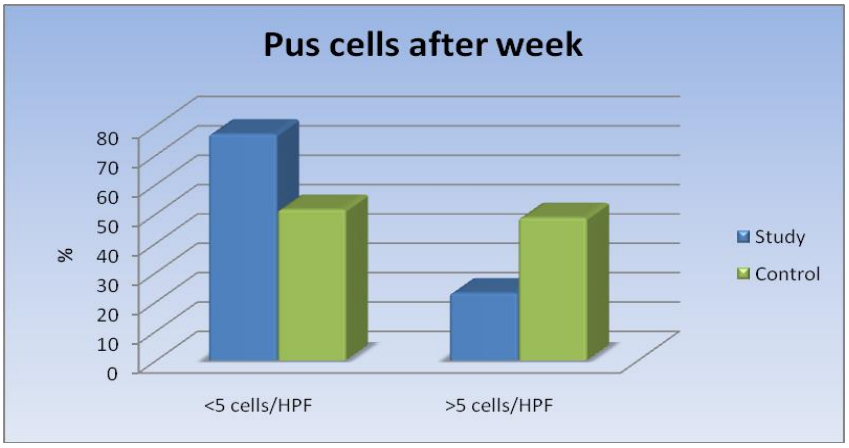

Figure (3): Bar chart representing pus cells count after week in the two groups with (p-value=0.025).

Table (6): Comparison between the study and control group regarding urine cultures.

Test	Study (n = 35)		Control (n = 35)		Test statistic	*P*-value
	N	%	N	%		
Colony count (After week)						
Sterile	30	85.7	20	57.1	*Fisher's Exact test* = 7.231	0.045*
<10000 CFU/ml	3	8.6	6	17.1		
10000–100000 CFU/ml	2	5.7	7	20		
>100000 CFU/ml	0	0	2	5.7		
Microorganisms (After week)						
E-Coli	2/5	40	4/15	26.7	*Fisher's Exact test* = 1.459	0.826
Klebsiella	2/5	40	4/15	26.7		
Staphylococci	0/5	0	3/15	20		
Candida	1/5	20	4/15	26.7		

**Significant at $P \leq 0.05$*

Table (7): Descriptive statistics and results of the association between characteristics of urinary catheter and prevalence of UTI

Item	No UTI (n=50)		UTI (n=20)		Test statistics	P- Value
	N	%	N	%		
Reason for catheterization						
Measure urine output	33	66	13	65	x^2=1.215	0.802
Urinary retention	4	8	1	5	*Fisher's Exact test* =1.404	0.825
Limited mobility	24	48	15	75	x^2=5.684 *Fisher's Exact*	0.118

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Urinary incontinence	7	14	2	10	*test* = 0.470	1.000
Size of catheter						
14 Fr	1	2	1	5	*Fisher's Exact*	
16 Fr	24	48	12	60	*test* =5.920	0.491
18 Fr	25	50	7	35		
Frequency of catheter change						
No						
Once	45	90	11	55	x^2=10.972	0.012*
	5	10	9	45		
Complication of insertion						
Difficult insertion	4	8	2	10	*Fisher's Exact*	
Trauma of urethra	0	0	1	5	*test* =12.433	0.191
Bleeding	3	6	1	5		

**: Significant at P ≤ 0.05*

Table (8): Descriptive statistics and results of the association between blood tests and prevalence of UTI

Item	No UTI (n=50)		UTI (n=20)		Test statistics	P- Value
	N	%	N	%		
Hb after 1 week						
Normal level	18	36	1	5	x^2=7.251	0.065
Less than normal level	32	64	19	95		
Creat after 1 week						
Normal level	42	84	9	45	x^2=12.139	0.004*
More than normal level	8	16	11	55		
Leukocytes after 1 week						
Normal level	42	84	5	25	*Fisher's Exact*	
< 4000 C/mm	1	2	1	5	*test* =26.907	0.000*
> 11000 C/mm	7	14	14	70		

**: Significant at P ≤ 0.05*

4. DISCUSSION

Catheter associated urinary tract infections (CAUTI) are a major patient safety concern, causing patient morbidity, mortality, and increased health care costs. CAUTI is a urinary tract infection that occurs two days after a catheter is inserted or one day after the catheter is discontinued **American Nurses Association(ANA),(2013).**

The results of the present study revealed that, the studied patients from the study and control group were homogenous related to their socio-demographic characteristics, medical data, and characteristics of urinary catheters. This finding is similar to **Fakih, Pena, shemes, Rey, Berriel-Cass et al. (2010)**, who reported that, the two groups were similar to each other in socio-demographic characteristics, and medical data.

In the present study, finding regarding to the patient's characteristics revealed that, about half of the total studied patients were in the age group from 50-65 years old. This finding is supported by **Zhong, Fang, Zhou, Tang, Gong et al. (2011),** who reported that, more than half of the studied patients from 50-65 years old, while this result disagrees with **Chung, Chen, and Yeh, (2012)**, who mentioned that, more than one third of the studied patients from 30-49 years old.

Concerning gender and marital status, it was found that, more than half of the patients in both control and study group were male and married. This result is supported by **Ahmed, (2010)**, who reported that, most of the studied patients were male and married.

Concerning medical diagnosis, this study reported that, about half of the studied patients were diagnosed with neurological diseases as stroke. This finding is in line with **Titsworth, Hester, Correia, Reed, Williams et al. (2012)**, who reported that, neurological disease specially stroke due to ischemia or hemorrhage is the most common ICU diagnosis.

As regards level of consciousness and mobility, the result of the current study represents that, about half of the total studied patients were unconscious as well as immobile. This finding may be contributed to multiple invasive procedures like mechanical ventilation, urinary catheterization, and critical diagnosis of the patients in Intensive Care Units. This result is in accordance with **Cavallazzi, Saad, and Marik (2012)**, who stated that, most patients admitted to ICU usually were immobile and had a different level of altered consciousness.

According previous hospitalization and previous UTI, this study stated that, more than one quarter of total studied patients were previously hospitalized and less than ten percent of the patients had a previous UTI. This finding is against **Gomaa, (2011)**, who reported that, about half of the studied patients were previously hospitalized and developed CAUTI.

Regarding the reason for catheterization; result revealed that about two third of the studied patients used a catheter to measure urine output correctly. This finding supported by **Raffaele, Bianco, Aiello, and Pravia, (2008)**, who reported that, more than three quarters of the studied patients use of catheterization to monitor urine output.

As regards urine cultures; this study showed statistically significant difference in colony count between study and control group in which about fifteenth percent of study group had colony count in urine culture, while about half of the patients in the control group had colony count in urine culture. This result showed that, not only type of catheter material that decrease incidence of CAUTI but also technique of catheter insertion, age, risk factors, and post catheterization care. This result agrees with **Abo El Nasser, (2013)**, who reported that, half of the patients in the control group had positive urine culture ,while less than one quarter of the patients in the study group had positive urine culture.

Regarding micro-organisms; this result show that, the most common micro-organism was E. Coli and Klebsiella followed by Candida. This finding is in line with **Kazi, Harshe, Sale, Mane, Yande et al. (2015)**, who reported that, the most common uropathogen with CAUTI is E. Coli followed by Klebsiella.

There was a statistically significant among the studied patients regarding the association between frequency of catheter change and prevalence of UTI. Changing the catheter once for any cause as leakage, blockage or Pull out was associated with the occurrence of UTI. This may be explained by leakage and blockage contributes to adherence of fibrin, RBCs and inflammatory cells to catheter opining. This finding is in line with **Smeltezer et al, (2010)**, who mentioned that, leakage and blockage are common in infected patients with UTI.

There was a statistically significant among the studied patients regarding the association between creatinine as well as leukocytes at the end of the study period and prevalence of UTI. Occurrence of CAUTI is accompanied with increased level of both serum creatinine and white blood cells (WBCs) and decrease in hemoglobin level. This finding supported by **Gray, (2010)**, who reported that, hemoglobin level less than normal range and increased level of serum creatinine has been identified as a potential risk factor for CAUTI.

5. CONCLUSION

Based on the results of the present study, it can be concluded that, the studied patients from the study and control group were homogenous related to their socio-demographic characteristics, medical data and characteristics of urinary catheters. Age of the studied patients ranged from 20-64 years old. There is a statistically significant difference between study and control group regarding colony count at the end of the study period, in which the study group showed lower prevalence of colony count than control group. There is a statistically significant difference between study and control group regarding leukocytes and serum creatinine at the end of the study period, in which level of Leukocytes and serum creatinine increased above the normal level in the control group than study group.

6. RECOMMENDATION

Based on the results of the present study the following recommendations were suggested**:** Apply the modified nursing intervention protocol for urinary catheter insertion by using sterile technique and provide maintenance care for the catheter after insertion to decrease the incidence of catheter associated urinary tract infections. Further studies have to be carried out in order to evaluate the effectiveness of the application of guidelines for catheter insertion on patient outcomes regarding incidence of CAUTI.

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