Effect of Applying Nursing Guidelines on Reducing Catheter Associated Urinary Tract Infection among Critically Ill Patients

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Abstract

Background: Catheter associated urinary tract infections (CAUTIs) are the most common healthcare associated infections (HAIs). It leads to substantial morbidity in hospitalized patients. **Aim:** The current study aimed to evaluate the effect of applying nursing guidelines (NG) on reducing CAUTI among critically ill patients (CIPs). **Design:** A quasi-experimental research design was utilized. **Setting:** This study was conducted at the Traumatic Intensive Care Unit (TICU), Minia University Hospital (MUH), at Minia City (MC), Egypt. **Subjects:** A purposive sample of 60 patients of both sexes was divided into intervention and control groups. The intervention group (IG) received the NG for preventing CAUTIs, while the control group (CG) received routine hospital nursing care. **Tools:** Two tools were used: **First Tool:** Patient Health Assessment (PHA, includes two parts, **First Part:** Demographic Data (DD) **Second Part:** Medical Data (MD) **Second Tool:** Catheter Associated Urinary Tract Infection Checklist (CAUTIC). **Results**: there was a low percentage of infection manifestation among IG compared to CG having the highest percent at the 4th, 5th, and 6th days. Nursing guidelines to prevent CAUTIs had success in reducing the incidence of CAUTIs among IG and improving patient outcomes. There was a correlation between respiratory rate and CAUTI criteria among IG and CG at the 3rd and 6th days, with a highly statistically significant difference. **Conclusion:** Implementation of the nursing guidelines lowers the incidence of CAUTI among the IG compared to the CG. **Recommendations**: Replication of the recent study on a larger probability sample from dissimilar geographical settings to generalize the finding.

Key Words: Catheter Associated Urinary Tract Infection, Critically Ill Patients

Introduction

Catheter-associated urinary tract infections (CAUTIs) are urinary tract infections (UTIs) occurring in a patient or has been catheterized within the past 48 hours **(Werneburg, 2022).** CAUTI can lead to serious complications in CIPs during a hospital stay **(Mauger, 2022).** In the United States (US), it is estimated that up to 80% of UTIs in hospital are associated with indwelling urinary catheters (IUC), which are commonly used in CIPs to monitor urine output and manage urinary incontinence (UI) **(Werneburg, 2022).**

Catheter-associated urinary tract infections are the most common healthcare-associated infections (HAIs) worldwide, accounting for up to 40% of all HAIs **(Soundaram et al., 2020).** CAUTI accounts for one million cases per year in the US. They are the most common cause of secondary bloodstream infections **(Werneburg, 2022).** The incidence of CAUTIs approximately ranged from 10 to 35 per 1000 patients in developing countries. Similarly, in African countries, including Egypt, CAUTIs are the most common HAIs accounting for 80% of hospital-acquired infections (HAIs) **(Teshager et al., 2022).** The global burden of CAUTIs underscores the importance of developing effective strategies to prevent these infections.

Contribute factors of CAUTI include prolonged catheterization, female gender, increased age, sever illness, obesity, inappropriate use of IUC and antibiotics, and bacterial contamination due to manipulation of the catheter **(Ndomba et al., 2022).** Nurses are essential in preventing and managing CAUTIs; they are responsible for IUC placement, daily catheter management, urine specimen collection (USC), and removal of the IUC. Nurses play a vital role in the diagnosis of CAUTI, as they are often the first to notice a clinical change or technical problem **(Alqarni, 2021).**

Significance of the Study

Complications of IUC affect patients' well-being, mostly physically, emotionally, and socially. Most complications documented in several studies include catheter blockages, urine leakage, urethral hemorrhage, urethritis, bladder spasms, bladder stones, and bladder cancer over the years. However, the most frequent and serious complication is CAUTI, which is associated with reduced quality of life, increased risk of hospitalization, and increased mortality. Also, CAUTI can lead to serious complications, including sepsis, pyelonephritis, and bacteremia **(Ndomba et al., 2022)**. Therefore, it is essential to prevent CAUTI in CIPs.

Aim of the Study:

The present study aimed to evaluate the effect of applying NG on reducing CAUTI among CIPs.

Research Hypothesis:

To fulfill the aim of this study, the following research hypothesis was formulated:

The CIPs who received NG would get reduced CAUTI among the intervention group (IG) compared with the control group (CG).

Operational Definition:

- **Catheter-associated urinary tract infection (CAUTI)** is a UTI in a patient with an indwelling urinary catheter (IUC) **(Perrin et al., 2021).**

Research Design:

A quasi-experimental (QE) research design was utilized in the current study. It can be utilized to examine the relationship between variables containing the independent (cause) side and dependent (effect) side.

Setting:

The current study was conducted at the Traumatic Intensive Care Unit affiliated to the Minia University Hospital in Minia City, Egypt. It is located on the first floor and consists of 12 beds.

Subjects:

A purposive sample of 60 patients of both sex was collected over (16) months, from February 2020 to May 2021. The sample size was estimated by using the **(Mohapatra & Chamola, 2020)** formula, which is computed as ($n = z^2 \times p (1- p) / d^2$). Where n = sample size, Z = Z statistic for a level of confidence, P= expected prevalence or proportion (in proportion of one; if 20%, P = 0.02 and d = precision (in proportion of one; if 5%, d= 0.05)

$N= (1.96)^2 \times 0.04 (1-0.04) / (0.05)^2 = 60$ patients.

The estimated required sample size was 60 patients, and they were classified equally and conveniently into two groups: the IG (n =30) who were willing to participate in the current study and the CG (n =30) who were subjected to routine hospital nursing care. Both groups in the current study were selected according to the following inclusion and exclusion criteria.

Inclusion Criteria

All CIPs aged from 18 to 60 years, and patients connected with a urinary catheter for not less than 7 days.

Exclusion Criteria

Patients were not willing to participate in the study, patients with urinary tract infection or any other systemic infection, patients who were admitted previously within six months, and immunocompromised patients.

Tools for Data Collection

The current study data was collected using two tools. These tools were developed by the investigator after revising an extensive relevant literature review. These tools are as follows:

First Tool: Patient Health Assessment (PHA): It includes two parts:

- **1st Part:** Demographic data such as age, sex, level of education, marital status, and residence.
- **2nd Part:** Medical data, including the date of admission, medical diagnosis, type of medication, Glasgow coma scale (GCS) and daily inspection of the external genitalia to assess infection manifestations such as (redness, cloudy urine, and foul-smelling urine). Hemodynamic variables (Temperature, Heart Rate, Blood pressure, Respiration, and Oxygen Saturation).

Second Tool: Catheter-Associated Urinary Tract Infection Checklist. It is adapted from the (CDC, 2020 Appendix II):

- **1st Part:** Catheter-Associated Urinary Tract Infection risk factors: it includes (type of inserted catheter, date of catheter insertion, date of catheter change, was the catheter removed before discharge from ICU).
- **2nd Part:** Catheter-Associated Urinary Tract Infection Manifestation criteria include two items:
  1- Clinical criteria; (Fever > 38 °C).
  2- Laboratory criteria; no bacterial growth, positive quantitative urine culture of a bacterial count $\geq 10^5$ /ml with no more than 2 species of microorganisms; pyuria Pus cells $\geq$ 3/ml in urine; positive urine culture of $\geq 10^3$ and $<10^5$ colony-forming unit (CFU)/ml with no more than 2 species of microorganisms.

Tools Validity:

Content validity was done to identify the degree to which the tools used measure what was supposed to be measured. The developed tools were examined by a panel of five experts' opinions in the fields of Medical Surgical Nursing (MSN) and Critical Care Nursing (CCN) specialties: One Professor of MSN at Ain-Shams University's and two Assistant Professors of CCN Specialty at Assuit University's (AU)- Faculty of Nursing, and two Assistant Professor of MSN at MU- Faculty of Nursing. The tools were examined for content coverage, clarity, relevance, applicability, wording, length, format, and overall appearance. All jury members (100%) agreed that the current study tools were valid and relevant to the aim of the study.

Tools Reliability:

Reliability was ascertained statistically by using the Alpha Cronbach test to ensure that the study tools were reliable. Reliability of the PHA and CAUTI Checklist were (0.77 and 0.89) respectively.

Pilot Study

A pilot study was carried out on 10% (n = 6) of the total sample of patients admitted to the previously mentioned ICU, meeting inclusion criteria to test the applicability, clarity, and objectivity of the study tools and estimate the time required for fulfilling them. Based on the results of the pilot study, no modifications were made to data collection tools so; the patients who were included in the pilot study were also included in the actual study sample.

Ethical Considerations

Official permission to conduct the study was obtained from the ethical committee of research (REC), NF, and MU, and second permission was obtained from the director of the traumatic intensive care unit for approval to gather data for research. Written informed consent from patients was obtained to participate in the study after explaining the aim, purpose, procedure, and nature of the study. Patients had the right to refuse to participate or withdraw from the study independently at any time without any rationale.

Study Procedure

Preparatory Phase

The current study was conducted by preparing different data collection tools by reviewing the current and relevant related literature and theoretical knowledge of the various related aspects using textbooks, articles, and periodical magazines.

Implementation Phase

The researcher started acquiring information by attending to the selected settings every day throughout the day shifts after receiving formal approval for carrying out the intended study. The investigator obtained written informed consent from those who agreed to participate in the study. Next, those patients were divided randomly into two equal groups. Data collection started with the CG and then with the IG, using two tools. The implementation period for the first and second tools was one hour. The IG received the CDC nursing guidelines for the prevention of CAUTI. The first time, the investigator selects the appropriate IUC, sterile gloves, a, syringe filled with saline, and disposable gloves for cleansing the patient's urethral area. Then follow strict aseptic technique throughout the actual IUC insertion procedure, starting with hand hygiene, inserting an indwelling urinary catheter to an appropriate length, and checking urine flow before balloon inflation to prevent urethral trauma. After that, inflate the IUC balloon correctly, check the drainage system for closed connections, no obstructions, or kinks, and maintain the drainage bag below the level of the bladder, not on the floor. Finally, hand hygiene is completed. Daily care and catheter maintenance for IG.

Evaluation Phase

The studied groups were observed over six days using the second part of the first tool to assess any changes in hemodynamic parameters, the level of GCS, and the presence of external genitalia infection manifestations. Also, the investigator used the second tool and the first and second parts to evaluate the presence of CAUTI.

Limitations of the Study

Findings are less amenable to generalization because the sample was selected from one geographical area in Egypt.

Statistical Analysis of Data:

The collected data were coded and entered into the Statistical Package for the Social Science (SPSS 21.0). An estimate was considered significant if the p-value was < 0.05. The characteristics of the study patients were compared among patients regarding the CAUTI guideline and CAUTI incidence. The continuous variable was expressed as mean ± standard deviation (SD) and compared by the student's t-test for normally distributed data. Categorical data were presented as numbers and percentages and compared by the Chi-squared test. If the table has any cell with less than 5 (but not zero) then Fisher exact test was used. P-value of less than 0.05 is considered significant

Results

Table (1): Frequency Distribution of the Studied Groups Regarding Their Demographic Data (n=60)

Demographic Data	Intervention Group (n=30)		Control Group (n=30)		χ^2	P-Value
	No.	%	No.	%		
Age (Years)						
18-28	12	40.0%	10	33.33%	4.726	0.188 NS
29-39	10	33.33%	9	30.0%		
40-49	2	6.67%	8	26.67%		
50-60	6	20.0%	3	10.0%		
Mean ± SD	33.70±13.21		35.53±11.49			
Gender						
Male	25	83.33%	27	90.0%	<0.0001	0.706 NS
Female	5	16.67%	3	10.0%		
						Residence
Urban	4	13.33%	4	13.33%	<0.0001	1.000 NS
Rural	26	86.67%	26	86.67%		
Level of Education						
Illiterate	1	3.33%	0	0.0%	1.411	0.703 NS
Read and Write	2	6.67%	2	6.67%		
Diploma	20	66.67%	21	70.0%		
Bachelor	7	23.33%	7	23.33%		
Marital Status						
Single	12	40.0%	10	33.33%	0.287	0.592 NS
Married	18	60.0%	20	66.67%		

NS: Not Significant

Table (1) Shows that slightly more than one third of the IG were within the age group of (18–28) years. Also, the table revealed that more than half of the intervention and control groups were male (83.33%, 90.0%) respectively. In regard to marital status, (60.0%, 66.67%) of the intervention and control groups were married, and the majority of the studied groups came from rural areas. Concerning the level of education, it was revealed that diploma-degree patients formed the highest percentage among the studied groups, about two-thirds of them. Lastly, there were no statistically significant differences between the intervention and control groups according to their demographic characteristics.

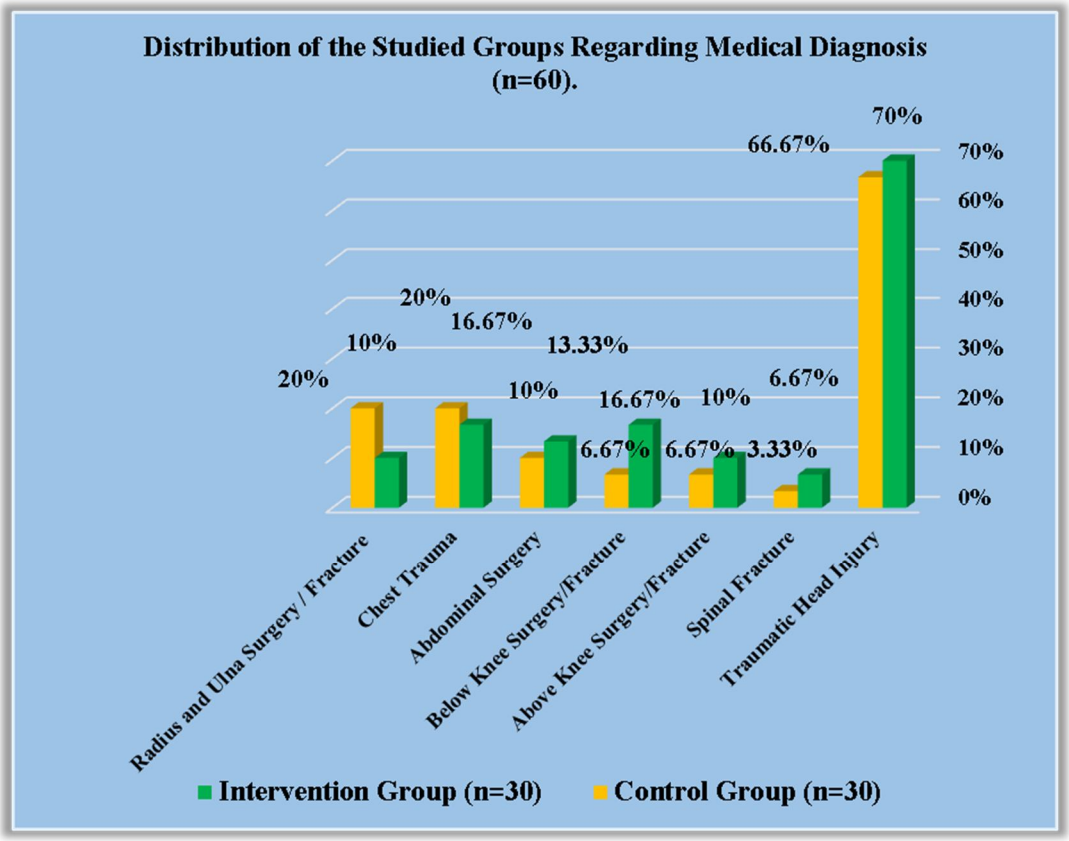

Figure (1): Distribution of the Studied Groups Regarding Medical Diagnosis (n=60).

Figure (1): Illustrates that 70% of the IG, compared with 66.67% of the CG, had a traumatic head injury. Lastly, there were no statistically significant differences between the studied groups regarding medical diagnosis.

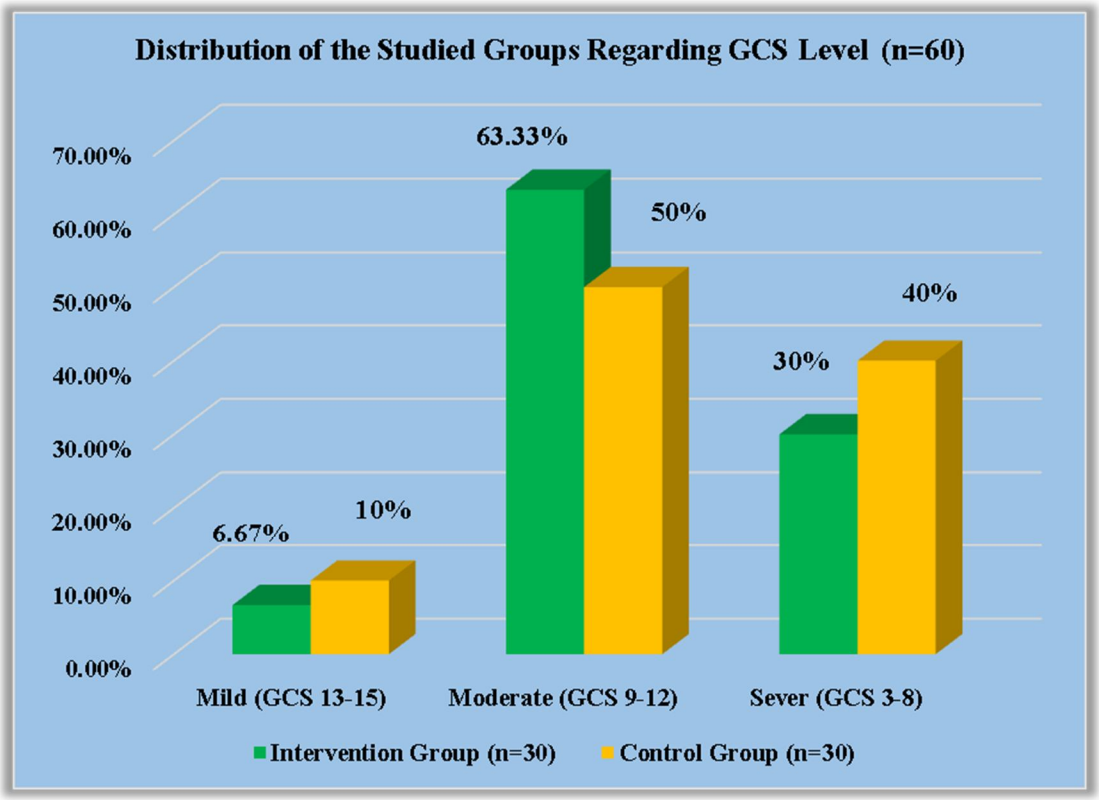

Figure (2): Distribution of the Studied Groups Regarding GCS (n=60).

Figure (2): Illustrates that the proportions of GCS at levels mild, moderate, and severe in patients were respectively 6.67%, 63.33% and 30% in the IG while the proportions were 10%, 50% and 40% in the CG. Lastly, there were no statistically significant differences between the studied groups regarding GCS.

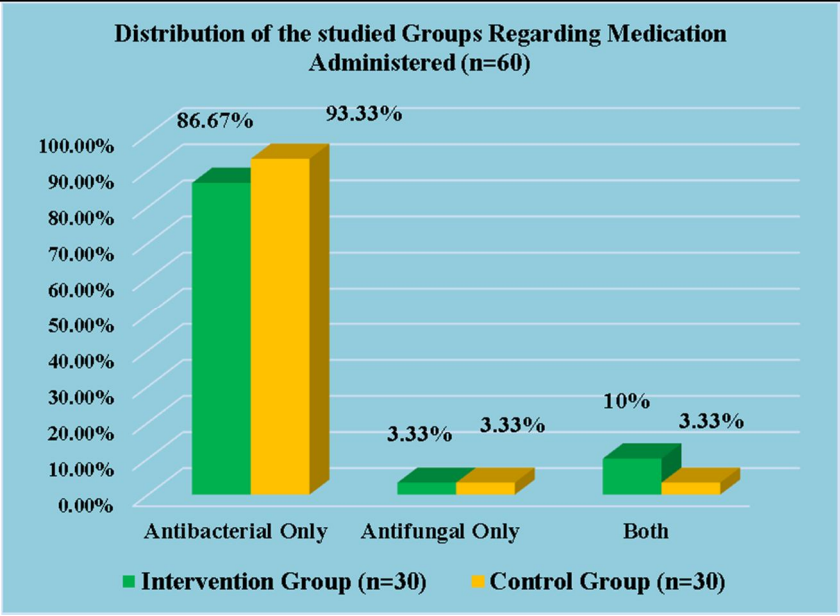

Figure (3): Distribution of the Studied Groups Regarding Medication Administered (n=60).

Figure (3): Illustrates that 86.67% of the IG compared with 93.33% of the CG received antibacterial medication only. Lastly, there were no statistically significant differences between the studied groups regarding medication administration.

Table (2): Comparison between the Intervention and Control Groups Regarding the Hemodynamics Mean Score Over the Six Days (n= 60).

Hemodynamic Data	Intervention Group (n=30) Mean ± SD	Control Group (n=30) Mean ± SD	t Test	P-Value
Temperature				
1st day	37.05±0.32	37.20±0.25	2.07	0.043*
2nd day	37.17±0.33	37.38±0.28	2.763	0.008*
3rd day	37.21±0.25	37.53±0.83	2.037	0.049*
4th day	37.41±0.32	37.82±0.48	4.007	<0.001**
5th day	37.35±0.41	37.97±0.57	4.848	<0.001**
6th day	37.23±1.30	38.18±0.61	3.621	0.001**
Respiration				
1st day	19.45±1.97	21.47±2.99	1.904	0.057NS
2nd day	19.88±1.74	22.36±2.99	2.793	0.005**
3rd day	20.29±1.78	23.77±4.13	2.089	0.037*
4th day	20.94±2.58	25.50±4.62	3.42	0.001**
5th day	21.14±3.49	26.82±5.34	4.21	<0.001**
6th day	21.44±3.49	28.29±5.60	4.654	<0.001**
Pulse				
1st day	90.61±16.96	92.66±19.08	0.441	0.661 NS
2nd day	92.31±19.14	95.91±19.29	0.761	0.449 NS
3rd day	90.43±20.21	98.36±21.64	1.465	0.148 NS
4th day	91.65±19.15	102.4±22.08	2.016	0.048*
5th day	93.76±21.78	105.57±23.47	2.042	0.046*
6th day	93.67±23.72	109.07±25.11	2.448	0.017*
Systolic Blood Pressure				
1st day	117.35±9.32	116.40±8.28	0.415	0.680 NS
2nd day	117.07±10.24	118.57±6.60	0.666	0.508 NS
3rd day	118.9±11.80	119.12±9.87	0.071	0.499 NS
4th day	118.29±9.68	112.51±9.19	2.371	0.021*
5th day	118.96±7.68	109.90±10.62	3.783	<0.001**
6th day	117.23±12.29	107.35±14.25	2.878	0.006**
Diastolic Blood Pressure				
1st day	74.46±8.35	72.96±6.47	0.605	0.584 NS
2nd day	71.91±7.37	73.78±6.33	0.595	0.554 NS
3rd day	73.68±7.49	71.34±8.08	1.160	0.251 NS
4th day	74.12±7.94	67.85±9.83	2.720	0.009**
5th day	72.46±6.94	65.73±9.13	3.209	0.002**
6th day	72.01±9.04	63.07±12.06	3.250	0.002**
Peripheral Oxygen Saturation (SPO_2)				
1st day	98.48±2.22	98.45±1.39	0.045	0.962 NS
2nd day	98.54±1.43	98.26±1.61	0.735	0.465 NS
3rd day	98.44±1.74	97.71±1.55	1.750	0.085 NS
4th day	98.51±1.33	97.59±1.39	2.630	0.011*
5th day	98.71±1.0	97.72±1.74	2.702	0.009**
6th day	98.411±1.02	97.38±1.66	2.904	0.005**

***Statistically Significant difference (P Value < 0.05).**
**** High Statistically Significant difference (P Value < 0.01**

Table (2): Displayed that, there were statistically significant differences between both groups regarding temperature over the six days documented by *p*-value (0.043, 0.008, 0.049, 0.001, 0.001, and 0.001), respectively. Also, the table reflected that there were statistically significant differences among both groups regarding respiration from the 2nd day to the 6th day as documented by *p*-value (0.005, 0.037, 0.001, 0.001, 0.001) respectively. As regards pulse there were statistically significant differences among both groups during the 4th, 5th, and 6th day as documented by *p*-value (0.048, 0.046, 0.017) respectively.

As regards the systolic and diastolic blood pressure, there were statistically significant differences among both groups during the 4th, 5th, and 6th days, documented by p-values (0.021, 0.001, 0.006) (0.009, 0.002, 0.002), respectively. Also, it was noticed that there were statistically significant differences among both groups regarding oxygen saturation during the 4th, 5th, and 6th days, as documented by p-values (0.011, 0.009, and 0.005) respectively.

Table (3): Distribution of Bacterial Growth in Urine Culture among Intervention and Control Groups on the 3rd and 6th Days (n= 60).

Bacterial Growth in Urine Culture	Third Day		Sixth Day	
	Intervention Group (n=30)	Control Group (n=30)	Intervention Group (n=30)	Control Group (n=30)
	N (%)	N (%)	N (%)	N (%)
No Growth				
Yes	**28(93.34%)**	**15(50%)**	**26(86.66%)**	**9(30.0%)**
No	**2(6.66%)**	**15(50%)**	**4(13.34%)**	**21(70%)**
χ^2	**13.872**		**19.817**	
***P* – Value**	**<0.001****		**<0.001****	
Positive Urine Culture of ≥10^5 CFU/mL				
Yes	**2(6.66%)**	**4(13.34%)**	**3(10.0%)**	**14(46.66%)**
No	**28(93.34%)**	**26(86.66%)**	**27(90%)**	**16(53.34%)**
χ^2	**0.7407**		**9.932**	
***P* – Value**	**0.389 NS**		**0.0016****	

***Statistically Significant Difference (P Value < 0.05).**
**** High Statistically Significant Difference (P Value < 0.01). (CFU): Colony-Forming Units**

Table (3): Displayed that 6.66% of the IG compared to 13.34% of the CG had positive urine cultures ≥10^5 CFU/mL, at the third day, with statistically significant differences of P 0.001. In addition, 10.0% of the IG had positive urine cultures, compared to 46.66% of the CG which had positive urine cultures ≥10^5 CFU/mL, with statistically significant differences at a p-value <0.001.

Table (4): Comparison between Intervention and Control Groups Regarding the CAUTI Criteria on the 3rd and 6th Days (n= 60).

CAUTI Criteria	Third Day		Sixth Day	
	Intervention Group (n=30)	Control Group (n=30)	Intervention Group (n=30)	Control Group (n=30)
	N (%)	N (%)	N (%)	N (%)
Fever > 38 C°.				
Yes	2(6.66%)	15(50%)	6(20.0%)	21(70%)
No	28(93.34%)	15(50%)	24(80%)	9(30%)
χ^2	15.244		15.901	
***P* – Value**	<0.001 **		<0.001**	
Positive Urine Culture				
Yes	2(6.66%)	4(13.34%)	3(10.0%)	14(46.66%)
No	28(93.34%)	26(86.66%)	27(90%)	16(53.34%)
χ^2	5.831		10.569	
***P* – Value**	0.016*		0.001**	
Pyuria				
Yes	0(0.0%)	11(36.66%)	1(3.34%)	14(46.66%)
No	30(100%)	19(63.34%)	29(96.66%)	16(53.34%)
χ^2	17. 740		17.26	
***P* – Value**	<0.001**		< 0.001**	

***Statistically Significant Difference (P Value < 0.05). (CFU): Colony-Forming Units**
**** High Statistically Significant Difference (P Value < 0.01)**

Table (4) shows that 20% of the IG compared with 70.00% of the CG had fever. Also, 10.0% of the IG compared with 46.66% of the CG had positive urine cultures. It can also be seen that 3.34% of the IG compared with 46.66% of the CG had pyuria, with a statistically significant difference at the sixth day.

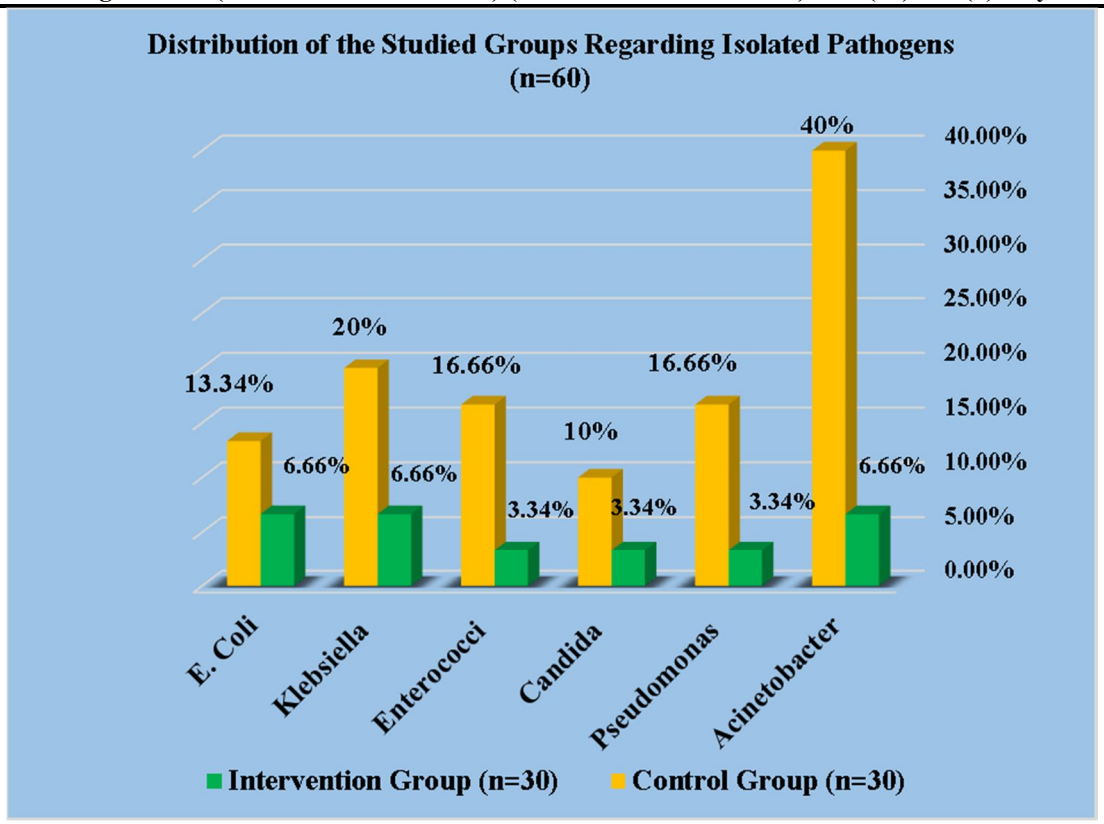

Figure (4): Distribution of the Studied Groups Regarding Isolated Pathogens (n=60).

Figure (4): Demonstrated that 6.66% of the IG compared with 40% of the CG had Acinetobacter as isolated pathogens, with a statistically significant difference

Table (5): Relation Between CAUTI Criteria and Demographic Data among Intervention and Control Groups (n= 60).

Demographic Data	CAUTI Criteria											
	Fever				Positive Urine Culture				Pyuria			
	Intervention Group (n=30)		Control Group (n=30)		Intervention Group (n=30)		Control Group (n=30)		Intervention Group (n=30)		Control Group (n=30)	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Age (Years)												
18-28	4 (13.34)	8 (26.66)	8 (26.66)	2 (6.67)	1 (3.33)	11 (36.67)	4 (13.34)	6 (20.0)	0 (0.0)	12 (40.0)	4 (13.34)	6 (20.0)
29-39	2 (6.67)	8 (26.66)	6 (20.0)	3 (10.0)	2 (6.67)	8 (26.66)	6 (20.0)	3 (10.0)	1 (3.33)	9 (30.0)	6 (20.0)	3 (10.0)
40-49	0 (0.0)	2 (6.67)	6 (20.0)	2 (6.67)	0 (0.0)	2 (6.67)	3 (10.0)	5 (16.66)	0 (0.0)	2 (6.67)	3 (10.0)	5 (16.66)
50-60	0 (0.0)	6 (20.0)	1 (3.33)	2 (6.67)	0 (0.0)	6 (20.0)	1 (3.33)	2 (6.67)	0 (0.0)	6 (20.0)	1 (3.33)	2 (6.67)
χ^2	3.333		2.540		2.037		2.109		2.069		2.109	
P – Value	0.343 NS		0.468 NS		0.565 NS		0.550 NS		0.558 NS		0.550 NS	
Gender												
Male	5 (16.66)	20 (60.67)	19 (63.34)	8 (26.66)	3 (10.0)	22 (73.34)	13 (43.34)	14 (46.66)	1 (3.33)	24 (80.0)	13 (43.34)	14 (46.66)
Female	1 (3.33)	4 (13.34)	2 (6.67)	1 (3.33)	0 (0.0)	5 (16.66)	1 (3.33)	2 (6.67)	0 (0.0)	5 (16.67)	1 (3.33)	2 (6.67)
χ^2	0.000		0.018		0.667		0.238		0.207		0.238	
P – Value	1.000 NS		0.894 NS		0.414 NS		0.626 NS		0.649 NS		0.626 NS	
Residence												
Urban	1 (3.33)	3 (10.0)	4 (13.34)	0 (0.0)	0 (0.0)	4 (13.34)	1 (3.34)	3 (10.0)	3 (10.0)	4 (13.34)	1 (3.34)	3 (10.0)
Rural	5 (16.67)	21 (70.0)	17 (56.66)	9 (30.0)	3 (10.0)	23 (76.66)	13 (43.33)	13 (43.33)	1 (3.33)	25 (83.33)	13 (43.33)	13 (43.33)
χ^2	0.072		1.978		0.513		0.871		0.159		0.871	
P – Value	0.788 NS		0.160 NS		0.474 NS		0.351 NS		0.690 NS		0.351 NS	
Level of Education												
Illiterate	0 (0.0)	1 (3.33)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.33)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.33)	0 (0.0)	0 (0.0)
Read and Write	0 (0.0)	2 (6.67)	1 (3.33)	1 (3.33)	0 (0.0)	2 (6.67)	1 (3.33)	1 (3.33)	0 (0.0)	2 (6.67)	1 (3.33)	1 (3.33)
Diploma	5 (16.67)	15 (50.0)	16 (53.33)	5 (16.67)	3 (10.0)	17 (56.67)	11 (36.67)	10 (33.33)	1 (3.33)	19 (63.34)	11 (36.67)	10 (33.33)
Bachelor	1 (3.33)	6 (20.0)	4 (13.34)	3 (10.0)	0 (0.0)	7 (23.33)	2 (6.67)	5 (16.67)	0 (0.0)	7 (23.33)	2 (6.67)	5 (16.67)
χ^2	1.205		1.315		1.667		1.205		0.517		1.205	
P – Value	0.518	NS	0.752	NS	0.644	NS	0.547	NS	0.915	NS	0.547	NS
Marital Status												
Single	5 (16.67)	7 (23.33)	7 (23.33)	3 (10.0)	3 (10.0)	9 (30.0)	3 (10.0)	7 (23.33)	1 (3.33)	11 (36.67)	3 (10.0)	7 (23.33)
Married	1 (3.33)	17 (56.67)	14 (46.67)	6 (20.0)	0 (0.0)	18 (60.0)	11 (36.67)	9 (30.0)	0 (0.0)	18 (60.0)	11 (36.67)	9 (30.0)
χ^2	5.868		0.000		5.000		1.674		1.552		1.674	
P – Value	0.015 *		1.000	NS	0.025 *		0.196 NS		0.213 NS		0.196 NS	

NS: Non-Statistically Significant ***Statistically Significant Difference (P Value < 0.05).**

Table (5): Shows that there were no statistically significant relations between CAUTI criteria and demographics regarding age, gender, residence, and level of education, while there were statistically significant relations between CAUTI criteria and marital status among the studied groups.

Table (6): Relation between CAUTI Criteria and Medical Data among Intervention and Control Groups (n= 60).

Medical Data	CAUTI Criteria											
	Fever				Positive Urine Culture				Pyuria			
	Intervention Group (n=30)		Control Group (n=30)		Intervention Group (n=30)		Control Group (n=30)		Intervention Group (n=30)		Control Group (n=30)	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Diagnosis (Multiple Response), *n=Intervention & Control*												
Traumatic Head Injury, *n=21&20*	6 (28.57)	15 (71.43)	14 (70.0)	6 (30.0)	3 (14.28)	18 (85.72)	10 (50.0)	10 (50.0)	1 (4.76)	20 (95.24)	10 (50.0)	10 (50.0)
Abdominal Surgery, *n=4 & 3*	1 (25.0)	3 (75.0)	3 (100)	0 (0.0)	0 (0.0)	4 (100)	2 (66.67)	1 (33.33)	0 (0.0)	4 (100)	2 (66.67)	1 (33.33)
Chest Trauma, *n=5 & 6*	0 (0.0)	5 (100)	5 (83.33)	1 (16.67)	0 (0.0)	5 (100)	4 (66.67)	2 (33.33)	0 (0.0)	5 (100)	4 (66.67)	2 (33.33)
Above Knee Surgery/Fracture, *n=3 & 2*	0 (0.0)	3 (100)	1 (50.0)	1 (50.0)	0 (0.0)	3 (100)	1 (50.0)	1 (50.0)	0 (0.0)	3 (100)	1 (50.0)	1 (50.0)
Below Knee, Surgery/Fracture, *n=5 & 2*	1 (20.0)	4 (80.0)	1 (50.0)	1 (50.0)	0 (0.0)	5 (100)	0 (0.0)	2 (100)	0 (0.0)	5 (100)	0 (0.0)	2 (100)
Spinal Fracture, *n=2 & 1*	0 (0.0)	2 (100)	1 (100)	0 (0.0)	0 (0.0)	2 (100)	0 (0.0)	1 (100)	0 (0.0)	2 (100)	0 (0.0)	1 (100)
Radius & Ulna Surgery / Fracture, *n=3 & 6*	1 (33.33)	2 (66.67)	3 (50.0)	3 (50.0)	1 (33.33)	2 (66.67)	3 (50.0)	3 (50.0)	1 (33.33)	2 (66.67)	3 (50.0)	3 (50.0)
χ^2	6.526		4.752		5.900		4.832		10.515		4.832	
***P* – Value**	0.480 NS		0.690 NS		0.552 NS		0.689 NS		0.161 NS		0.680 NS	
Glasgow Coma Scale Level												
Mild (GCS 13-15)	0 (0.0)	2 (6.67)	2 (6.67)	1 (3.33)	0 (0.0)	2 (6.67)	2 (6.67)	1 (3.33)	0 (0.0)	2 (6.67)	2 (6.67)	1 (3.33)
Moderate (GCS 9-12)	4 (13.33)	15 (50.0)	12 (40.0)	3 (10.0)	2 (6.67)	17 (56.67)	7 (23.33)	8 (26.67)	0 (0.0)	19 (63.34)	7 (23.33)	8 (26.67)
Sever (GCS 3-8)	2 (6.67)	7 (23.33)	7 (23.33)	5 (16.67)	1 (3.33)	8 (26.66)	5 (16.67)	7 (23.33)	1 (3.33)	8 (26.67)	5 (16.67)	7 (23.33)
χ^2	0.541		1.508		0.240		0.603		2.414		0.603	
***P* – Value**	0.763	NS	0.470	NS	0.887 NS		0.740 NS		0.299	NS	0.740	NS
Medication												
Antibacterial	5 (16.67)	21 (70.0)	20 (60.67)	8 (26.67)	3 (10.0)	23 (76.67)	14 (46.67)	14 (46.67)	1 (3.33)	25 (83.34)	14 (46.67)	14 (46.67)
Antifungal	0 (0.0)	1 (3.33)	1 (3.33)	0 (0.0)	0 (0.0)	1 (3.33)	0 (0.0)	1 (3.33)	0 (0.0)	1 (3.33)	0 (0.0)	1 (3.33)
Both	1 (3.33)	2 (6.67)	0 (0.0)	1 (3.33)	0 (0.0)	3 (10.0)	0 (0.0)	1 (3.33)	0 (0.0)	3 (10.0)	0 (0.0)	1 (3.33)
χ^2	0.593		2.789		0.513		1.875		0.159		1.875	
***P* – Value**	0.743	NS	0.248	NS	0.774	NS	0.392	NS	0.924	NS	0.392	NS

NS: Non-Statistically Significant

Table (6): Demonstrated that there was a relationship between CAUTI criteria and traumatic head injuries as MDs. The IG had a decrease in CAUTI criteria incidence compared to the CG, which had an increase in CAUTI criteria incidence. However, the studied groups with other diagnoses, including abdominal surgery, chest trauma, below-knee surgery or fracture, spinal fracture, radius, and ulna surgery or fracture, had a lower incidence of CAUTI. Furthermore, there were no statistically significant relations between CAUTI criteria and all medical data.

Table (7): Relation between CAUTI Criteria and Manifestation of Infection in External Genitalia at the 3rd and 6th Days.

Manifestation of Infection in External Genitalia	CAUTI Criteria											
	Fever				Positive Urine Culture				Pyuria			
	3rd Day		6thDay		3rd Day		6thDay		3rd Day		6thDay	
	I.G (n=2)	C.G (n=15)	I.G (n=6)	C.G (n=21)	I.G (n=2)	C.G (n=4)	I.G (n=3)	C.G (n=14)	I.G (n=0)	C.G (n=11)	I.G (n=1)	C.G (n=14)
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Redness												
Yes	0 (0.0)	2 (13.33)	5 (83.34)	14 (66.67)	0 (0.0)	2 (50.0)	3 (100)	14 (100)	-	2 (18.2)	1 (100)	14 (100)
No	2 (100)	13 (86.67)	1 (16.66)	7 (33.33)	2 (100)	2 (50.0)	0 (0.0)	0 (0.0)	-	9 (81.8)	0 (0.0)	0 (0.0)
χ^2	--	2.143	24.000	11.250	--	13.929	16.667	30.000	--	3.701	5.172	30.000
***P* – Value**	--	0.143NS	0.000**	0.001**	--	0.000**	0.000**	0.000**	--	0.054NS	0.023*	0.000**
Cloudy Urine												
Yes	0 (0.0)	0 (0.0)	3 (50.0)	14 (66.67)	0 (0.0)	0 (0.0)	3 (100)	14 (100)	--	0 (0.0)	1 (100)	14 (100)
No	2 (100)	15 (100)	3 (50.0)	7 (33.33)	2 (100)	4 (100)	0 (0.0)	0 (0.0)	--	11 (100)	0 (0.0)	0 (0.0)
χ^2	--	--	13.333	11.250	--	--	30.000	30.000	--	--	9.310	30.000
***P* – Value**	--	--	0.000**	0.001**	--	--	0.000**	0.000**	--	--	0.002**	0.000**
Foul Smelled Urine												
Yes	0 (0.0)	0 (0.0)	3 (50.0)	12 (57.1)	0 (0.0)	0 (0.0)	3 (100)	12 (85.8)	--	0 (0.0)	1 (100)	12 (85.8)
No	2 (100)	15 (100)	3 (50.0)	9 (42.9)	2 (100)	4 (100)	0 (0.0)	2 (14.2)	--	11 (100)	0 (0.0)	2 (14.2)
χ^2	--	--	13.333	8.571	--	--	30.000	22.857	--	--	9.310	22.857
***P* – Value**	--	--	0.000**	0.003**	--	--	0.000**	0.000**	--	--	0.002**	0.000**

I.G: Intervention Group, CG: Control Group ** High Statistically Significant Difference (P Value < 0.01). **NS: Non-Statistically Significant**

Table (7): Demonstrates that there were relationships between fever, which is a CAUTI criteria and redness, which is a sign of infection in the external genitalia, among the studied groups at the 6th day. Additionally, a highly statistically significant difference was observed between the CG on the third day and among the studied groups on the sixth day. Additionally, a relationship was noted between redness, a sign of infection in the external genitalia, and positive urine culture, which corresponds to CAUTI criteria among the CG on the 3rd day and among the studied groups on the 6th day and was highly statistically significant. In addition, there were highly statistically significant relationships between redness as a manifestation of infection in external genitalia and pyuria as CAUTI criteria among both groups at the 6th day, which showed a difference.

The present table depicts the relationships between both cloudy urine and a foul smell, which is a sign of infection in the external genitalia, and all CAUTI criteria among the studied groups on the sixth day with a highly statistically significant difference

Table (8): Correlation Between CAUTI Criteria and Hemodynamics among Intervention and Control Groups at the Third and Sixth Days.

Hemodynamics	CAUTI Criteria											
	Fever				Positive Urine Culture				Pyuria			
	3rd Day		6th Day		3rd Day		6th Day		3rd Day		6th Day	
	I.G (n=2)	C.G (n=15)	I.G (n=6)	C.G (n=21)	I.G (n=2)	C.G (n=4)	I.G (n=3)	C.G (n=14)	I.G (n=0)	C.G (n=11)	I.G (n=1)	C.G (n=14)
Temperature												
r	0.700	0.588	0.354	0.610	0.700	0.269	0.373	0.962	-	0.464	0.218	0.962
P	0.000**	0.001**	0.055	0.000**	0.000**	0.150	0.042*	0.000**	-	0.010**	0.247	0.000**
Respiratory Rate												
r	0.592	0.823	0.699	0.479	0.592	0.473	0.677	0.873	-	0.600	0.601	0.873
P	0.001**	0.000**	0.000**	0.007**	0.001**	0.008**	0.000**	0.000**	-	0.000**	0.000**	0.000**
Systolic BP												
r	0.190	0.024	-0.263	-0.496	0.190	-0.180	-0.059	-0.886	-	-0.482	-0.301	-0.886
P	0.315	0.900	0.161	0.005**	0.315	0.341	0.759	0.000**	-	0.007**	0.106	0.000**
Diastolic BP												
R	0.248	-0.222	-0.282	-0.536	0.248	-0.206	-0.134	-0.897	-	-0.656	-0.439	-0.897
P	0.187	0.238	0.131	0.002**	0.187	0.275	0.481	0.000**	-	0.000**	0.015*	0.000**
Pulse												
R	-0.0066	0.658	0.480	0.461	-0.066	-0.010	0.173	0.727	-	0.450	0.159	0.727
P	0.728	0.000**	0.007**	0.010*	0.728	0.960	0.360	0.000**	-	0.013*	0.400	0.000**
O_2 Saturation												
R	0.165	-0.183	-0.482	-0.324	0.165	0.206	-0.728	-0.162	-	0.044	-0.508	-0.162
P	0.385	0.333	0.007**	0.081	0.385	0.274	0.000**	0.393	-	0.819	0.004**	0.393

***Statistically Significant Difference (P Value < 0.05). ** High Statistically Significant Difference (P Value < 0.01). NS: Non-Statistically Significant.**
I.G: Intervention Group, I.C: Control Group

Table (8): Shows that the correlation between temperature and fever as CAUTI criteria among IG and CG. While there was a correlation between temperature and fever as CAUTI criteria only among CG at the 6th day, there was also a correlation between temperature and positive urine culture as CAUTI criteria only among IG at the 3rd day. While there was a correlation between temperature and positive urine culture as CAUTI criteria among IG and CG at the 6th day, in addition there was a correlation between temperature and pyuria as CAUTI criteria only among CG at the 3rd and 6th day with a high statistically significant difference. Also, there was a correlation between respiratory rate and CAUTI criteria among IG and CG at the 3rd and 6th days, with a highly statistically significant difference.

The current table depicts a correlation between systolic BP and both fever and positive urine culture as CAUTI criteria only among CG at the 6th day, with a high statistically significant difference. Also, there was a correlation between systolic BP and pyuria as CAUTI criteria among CG at the 3rd and 6th days, with a high statistically significant difference. Additionally, there was a correlation between diastolic BP and both fever and positive urine culture as CAUTI criteria only among CG at the 6th day. While there was a correlation between diastolic BP and pyuria as CAUTI criteria among CG at the 3rd and 6th days, with a high statistically significant difference.

Shows that there were correlations between pulse and CAUTI criteria among CG on the 6th day. While there was a correlation between pulse and both fever and pyuria as CAUTI criteria among CG on the 3rd day, with a statistically significant difference. Also, there was a correlation between oxygen saturation and CAUTI criteria among IG at the 6th with a high statistically significant difference

Discussion:

Regarding age, the current study shows that more than one-third of the intervention group was in the youngest age group. The investigator's perspective is that most patients are victims of road traffic accidents which mostly occur in the functional age period and need for ICU admission and urinary catheter insertion. The present study finding contradicted **(Alshehri, 2023),** who revealed that about one-third of the studied patients were in the oldest age groups. Also contrary to the finding of **(Chandna, Pandey, and Maheshwari, 2022),** they concluded that most of the study population belonged to the oldest age groups.

As **regards gender**, the present study found that the majority of the intervention group was males. The investigator's perspective is that males have a greater risk for motor car accidents and critical care unit admission and need for urinary catheterization because of altered consciousness level, invasive procedures, and immobility. The present study finding contradicted **(Omer et al., 2020)**, who revealed that a minority of the patients were male. In addition, the study done by **(Chandna et al., 2022)** reported that more than one third of the population was male.

The present study results revealed that the majority of the intervention group patients belonged to rural areas. The investigator's perspective is that most of the Governorates in Upper Egypt are made up of villages. Also, it may have poor health care facilities. The present finding was consistent with **(Hak et al., 2022),** who revealed slightly more than half of the patients in the study group belonged to rural areas. But it contradicts the study done by **(Bizuayehu, Bitew, Abdeta, and Semira, 2022),** which demonstrated that most of the studied patients lived in urban areas.

Concerning educational level, it has been noticed that two-thirds of patients in the intervention group had diploma degrees. The investigator's perspective is that the diploma level of education is widely recognized among low-income people and some of Egypt's rural culture does not allow individuals to complete their educational level. The present

study finding was consistent with **(Hak et al., 2022),** who revealed that less than half of the study group had secondary and university education. The current study results contradict **(Alhabdan, Alyaemni, Aljuaid, Baydoun, and Hamidi, 2023),** who revealed the majority of the participants had primary education.

The present study results revealed that about two-thirds of patients in the IG were married. The investigator's perspective is that most of the people in rural areas of Upper Egypt culturally tend to marry in early adulthood and other single patients could be in urban areas or aged less than 20 years. The present study finding was consistent with **(Alhabdan et al., 2023)** who revealed the majority of the participants were married. The present study finding contradicted **(Hak et al., 2022),** who indicated that one-third of the patients in the study group were married.

As regards the cause of ICU admission, the current study revealed that two-thirds of the IG had head trauma. There was no SSD between both studied groups by their distribution of the diseases. The investigator's perspective is that the study setting was traumatic, as data were collected from a traumatic ICU where patients were admitted with different modes of trauma, such as road traffic accidents (RTA) and falling from heights (FFH).The current study result is consistent with **(Pajerski, Harlan, Ren, & Tuite, 2022),** who said that one-third of the IG the reason behind their ICU admission was head trauma.

The present study results revealed that about one-third of the patients in the IG had severe disturbance of consciousness (GCS 3-8). The researcher's interpretation of the study's findings might be attributed to the fact that the most common diagnosis in the IG was a traumatic head injury. Contrary finding by **(Liu et al., 2023),** who found that two-thirds of the studied patients had a severe disturbance of consciousness with (GCS ≤8). Also, it contradicts **(Khatiban et al., 2022),** they indicated that the mean GCS of the patient in the experimental group was 9.38 ± 2.38.

Regarding the hemodynamics, the current finding revealed that there were statistically significant differences between both groups regarding the mean readings of temperature, respiration, pulse, systolic blood pressure, diastolic blood pressure, and peripheral oxygen saturation during the 4^{th}, 5^{th}, and 6^{th} days. The present study finding is consistent with (**Ahmed, & Shehata, 2020),** they revealed that the mean vital signs in the control group was higher than those of the experimental group especially for temperature, pulse, and respiration with significant difference ($P < 0.05$).

The current study revealed that the majority of the intervention group had no bacterial growth in urine culture at the sixth day with statistically significant differences $P < 0.001$. The researcher's point of view was that reduction in the number of positive growths in urine culture is related to the following CAUTI prevention guidelines. The present finding is consistent with (**Ahmed et al., 2020),** revealed that the highest percentage of the bundle group subjects has no bacterial growth.

The present finding is consistent with **(Hak et al., 2022),** they revealed that most of the patients in the control group had positive bacterial growth as compared to few of the patients in the study group had negative bacterial growth. The finding of the study agreed with (**Abd Ellatif, Ali, Mahmoud, & Attallah, 2018),** they revealed that the study group showed higher prevalence of patients with no bacterial growth than control group with (P-value = 0.045). Also, the current study results in the same line with **(Hassan, Kumar, Kumar, & Kumar, 2023),** they indicated that significant growth was observed among fifteen percent patients.

Concerning fever, the results of the present study revealed that twenty percent of the IG, compared with the highest percentage of the CG, had fever. The researcher's point of view was that these findings may be attributed to the fact that IG adheres to CAUTI nursing guidelines. The present study finding is in context of **(Mohd et al., 2022)**, who revealed that most patients presented only with a fever (n = 23, 33%), and there was a positive association between the fever and CAUTI.

Regarding positive urine cultures, the findings of the current study revealed that a minority of the IG had PUC, while nearly half of the CG had PUC at the sixth day. The present finding was consistent with **(Kranz et al., 2020),** who revealed that PUC was decreased in the IG. Also, the present study finding supported by **(Tyson et al., 2020),** revealed that PUC was decreased in post intervention group as compared to preintervention group. The finding of the current study agreed with (**Ahmed et al., 2020),** indicated that the majority of CG had PUC.

Regarding CAUTI criteria, the findings of the current study revealed that the IG had lower incidence of CAUTI, only ten percent of the IG as compared to nearly half of the CG had CAUTI criteria. The researcher's point of view was that reduction in the number of CAUTI occurrences is related to the following CAUTI prevention guidelines. The present finding is consistent with **(Sultan, Ahmed, & Kandeel, 2022),** they revealed that the implementation of the CAUTIs bundle resulted in a decrease in the CAUTIs rate among the CAUTIs bundle group rather than the traditional care group with an approximately 50% decrease in CAUTIs rate between both groups.

The finding of the current study agreed with **(Alshehri, 2023),** who revealed that the incidence of CAUTI among study participants decreased. Also, the current study results in the same line as **(Valdez, 2022),** who revealed that implementing the Toolkit (Elements of Proper Catheter Insertion and Maintenance) for reducing CAUTIs in hospital units significantly reduced the CAUTIs rate.

Concerning isolated pathogens, it has been noticed that a minority of the IG had acinetobacter as an IP, while nearly half of the CG had acinetobacter, with a statistically significant difference. The present finding is consistent with **(Bagińska et al., 2021)**, who found that acinetobacter is the main pathogen causing CAUTIs in ICUs.

The relation between CAUTI criteria and DD, the present result revealed that the incidence of CAUTI criteria was highest among studied groups younger than 40 years old. Furthermore, there were no statistically significant relations between CAUTI criteria and demographics regarding age, gender, residence, and level of education, while there were statistically significant relations between marital status and both fever and positive urine culture as CAUTI criteria among the studied groups. The current study finding was opposite with **(Juanjuan et al., 2021),** who revealed that the incidence of CAUTI was highest among patients aged equal to or more than 60 years old.

The relation between CAUTI criteria and MD, the present study reported that there was an increase in CAUTI incidence among IG and CG who were diagnosed with traumatic head injuries, while there was a decrease in CAUTI incidence between the studied groups who had other

diagnoses such as abdominal surgery, chest trauma, below knee surgery or fracture, spinal fracture, radius, and ulna surgery or fracture. Furthermore, there were no statistically significant relationships between CAUTI criteria and MD. The current study findings agreed with those of **(Sultan et al., 2022),** reported that there was head trauma patients high risk factor for CAUTI incidence. A similar finding was concluded by **(Pajerski et al., 2022),** who reported that the patients with traumatic brain injury were at increased risk of developing CAUTI.

The analysis of Glasgow Coma Scale, serving as an indicator of a patient's consciousness and neurological status, was classified into Mild (GCS 13-15), Moderate (GCS 9-12), and Severe (GCS 3-8) levels. Across all GCS levels, the IG consistently presents a lower proportion of patients with Fever compared to the CG, with the highest distribution in moderate GCS in both groups. Similarly, PUC data indicates higher incidence in moderate GCS level, with the highest proportion in moderate. Also, pyuria shows a higher distribution trend in moderate GCS in CG, however, it displays only one case having sever GCS in IG.

Despite the observed numerical variations, the Chi-Square tests revealed a lack of statistical significance across all CAUTI criteria and GCS levels. This implies that differences in proportions between both studied groups may be attributed to random variability rather than the impact of the intervention itself. The current study finding is consistent with **(Liu et al., 2023),** who revealed GCS ≤8 was well identified as risk factor associated with CAUTIs in hospitalized patients.

Concerning medication type, the present study reported that the IG guided by NG consistently demonstrates a lower proportion of patients with positive CAUTI indicators compared to the CG. While the observed differences are not statistically significant, the trends suggest a potential positive influence of NG on mitigating CAUTI criteria related to fever, PUC, and pyuria. Moreover, NG also appears to have an impact on the use of antifungal medications. The proportions of patients with positive CAUTI indicators in the IG are lower than those in the CG.

Although the differences are not statistically significant, the observed trends align with the potential benefits of nursing adherence to guidelines in reducing CAUTI-related complications. These outcomes underscore the potential role of NG influencing medication use and consequently CAUTI criteria. While statistical significance is not reached, the consistency in lower proportions within the IG implies a beneficial effect of nursing adherence to guidelines. The current study finding consistent with **(Gunardi et al., 2021),** who revealed more than two-thirds of the patients had been exposed to mostly broad-spectrum antibiotics.

In our study, it was observed that on both the 3rd and 6th days, the control group exhibited a higher frequency of redness, cloudy urine, and foul smell compared to the intervention group. These differences were statistically significant, emphasizing the potential benefits of implementing preventive measures in accordance with established guidelines. The current study results consistent with **(Van Veen et al., 2023)** who revealed CAUTI symptoms include cloudy or strong-smelling urine.

The findings of the present study reflect the correlations between CAUTI criteria and temperature and respiratory rate as parameters of hemodynamics among the studied groups at the 3rd and 6th days, with a high statistically significant difference.

Moreover, it was noticed that there were statistically significant correlations between systolic and diastolic BP, which is a parameter of hemodynamics, and CAUTI criteria among CG at the sixth day. Furthermore, the current finding reported that there were correlations between pulse and CAUTI criteria among CG at the 6th day. While there was a correlation between pulse and both fever and pyuria as CAUTI criteria among CG on the 3rd day, with a statistically significant difference Also, there was a correlation between oxygen saturation and CAUTI criteria among IG at the 6th day with a high statistically significant difference.

Conclusion:

Based on the study findings, it can be concluded that the majority of the IG had adequate adherence to the CAUTIs nursing guidelines. There was a positive correlation between CAUTI criteria and some hemodynamic parameters and manifestation of infection in external genitalia over 6 days, with a statistically significant difference.

Recommendations

1. **Nurses:**
- Designing an in-service training educational program for nurses to upgrade nurses' knowledge and practice regarding preventing CAUTI.

2. **Patients:**
- Designed brochure includes patient instruction to improve patients' knowledge and practice regarding lowering the incidence of CAUTIs.

3. **Further Research:**
- Replication of the current study on a larger sample size to generalize the findings.

4. **Hospital:**
- Assess the cost-effectiveness of implementing nursing guidelines for CAUTI prevention and explore potential strategies for resource allocation to support their implementation.
- Investigate the role of healthcare facility leadership and organizational culture in promoting adherence to infection prevention practices related to catheter use

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