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FACTORS INFLUENCING CAUTI OCCURRENCE IN ONE OF EGYPTIAN UNIVERSITY HOSPITALS ICU

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Sherief



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Abstract

Purpose: The purpose of the study was to determine CAUTI occurrence rate and factors influencing CAUTI occurrence in Intensive Care Unit (ICU) at Suez Canal university hospital.

Methodology: A total of 47 ICU patients for 312 bed days were collected through judgmental sample technique for two consecutive months. Data was gathered by; reviewing patients health records, observing patients daily and performing conditional urine cultures. Through two tools personal profile questioner and patient health status monitoring checklist.

Finding: The CAUTI occurrence rate was 54.48 /1000 catheter day. CAUTI occurrence was correlated with; diabetes mellitus that was 40.4% of total participants, prolonged hospitalization, ICU admission and nursing maintenance of urinary catheter malpractices was correlated to CAUTI occurrence among ICU patient.

Unique contribution to Theory, Practice and Policy: The present study recommends; enhancing early removal of IUC when no longer needed by application of reminding systems and nurse-driven protocol, use IUC alternatives to manage urinary incontinence and monitoring of urinary output, and implement CAUTI preventive bundles regarding IUC securement to the patient's body and to keep IUC tube patency.

Key words: *Factors, Intensive Care Unit, Indwelling Urinary Catheter*

1.0 INTRODUCTION

Intensive Care Units (ICUs) have provided life for many patients with life-threatening conditions. For example, shock states, trauma, heart and respiratory failure and others critical conditions that necessitate close monitoring with many invasive tubes and fast care. However, it is the top in rate of infection than inpatient units. Resulting in high mortality, morbidity and hospital stay that will lead to massive expenditure of such infection. [1], [2].

Healthcare-Associated Infection (HAI) is the most adverse outcome that effects both health setting and clients in form of patient safety issue, quality of care and burden [3]. Urinary Tract Infections (UTI) are among the most common type of HAI [4]. Approximately 75% UTIs are associated with Indwelling Urinary Catheter (IUC) placement into the patient urinary bladder [5]. The prevalence of catheter-associated urinary tract infections (CAUTI) in the ICUs is directly linked to the widespread use of IUC in these settings. CAUTI results in significant treatment cost of the infection itself or the accompanied disabilities [6].

In Egypt, the incidence of CAUTI is differed significantly according to type of hospital setting and ICU [7]. A study conducted in rural regions General Hospital, affiliated to Ministry of Health founded CAUTI incidence to be 90.12 per 1,000 catheter days [8]. While with active prospective surveillance study including ninety one ICU reported that 98.3% of UTI was attributed to IUC placement and that CAUTI incidence is influenced by ICU type that ranged from 0.5 to 3.3 infections per 1,000 patient days in surgical cardiothoracic and trauma ICU respectively [9].

2.0 METHODS

Study Design:

An observational study was conducted during period of two months from the beginning of September 2018 to the end of October 2018 in Suez Canal University Hospital Intensive Care Unit [SCUH-ICU].

Sampling:

A purposive sample was used to enable all eligible patients with inclusion criteria to be included in the study during two consecutive months. The total patients' sample was 47. The inclusion criteria included; adult ICU patients who were placed IUC for more than 48 hours and excluded; child patients less than 21 years old, patients with signs of UTI on admission and being catheterized with a suprapubic catheter.

Data Collection:

Assessment of critically ill patient having IUC was accomplished through two tools that were developed by the researcher based on the relevant literatures.

TOOL I: PERSONAL PROFILE QUESTIONER

The first tool was concerned of patient personal profile including; age, sex, date of admission to hospital and ICU (were converted to total number of hospital and ICU admission), history of comorbid condition that influence CAUTI development according to Richards (2017), patient's

discharge condition from ICU (either transfer to another medical unit or dead), and IUC characteristics involving; size, materials, total insertion days those items was collected once from patients admission nursing records and while IUC assessment [10].

TOOL II: PATIENT HEALTH STATUS MONITORING CHECKLIST

The second tool was a monitoring checklist and consisted of three sections; patients' health status, diagnosis criteria of CAUTI, and daily maintenance care for ICU that patients received according to CDC guidelines [11]. The first section was a daily assessment of patient health status through an observational checklist. The patient health status observational checklist consisted of; patient vital signs; was adapted from [12], tubes attached to studied ICU patients; adapted from [13], patients fluid status; adapted from [14], and clarity of urine; adapted from [15].

The second section aimed to facilitate monitoring of CAUTI signs and symptoms and urine culture to guide diagnosis of CAUTI. It was developed based on CDC CAUTI diagnosis criteria that involved IUC utilization for more than two consecutive days and to be in place on date of event or a day before and no more. Besides that, had at least one of these signs (fever >38 , suprapubic or costovertebral angle pain, urinary urgency frequency or dysuria without definite cause). Regarding to patients intubated for mechanical ventilation or disturbed level of consciousness nonverbal pain scale to identify suprapubic tenderness and including decreased level of consciousness as a sign of CAUTI in ICU [16]. All criteria of CAUTI must be involved with in seven days, three days before the first positive urinary culture and three days [17].

The Urinary culture ordering system that present in the SCUH-ICU was assessed to identify its indication. For all patients who were included in the study urinary culture was aspirated from the patients IUC drainage port maintaining close system technique using a sterile syringe and disinfect the puncture site for 10 minutes before aspirating the sample using a sterile alcohol swap. Urinary cultures were collected based on symptoms and disturbance in level of consciousness appeared on the patients daily assessment [10].

The third section was concerned with monitoring patients' IUC condition. This part was adopted from (Gordon, 2015) and involved presence of; external IUC securement with adhesive tape and location of securement if right or wrong, IUC tube obstruction and loops, correct urinary bag placement (below the bladder), IUC bag off the floor, container not over filled, and that if there were any break in catheter seal that usually documented in the patient document as; urinary irrigation or measuring abdominal pressure[18].

STATISTICAL ANALYSIS:

Statistical Package of Social science Version 20 (SPSS) was used to analyze collected data (IBM Corp, 2011). Data was analyzed for frequency, mean for parametric data and median for nonparametric data and correlation test [19].

ADMINISTRATIVE DESIGN AND ETHICAL CONSIDERATION

To carry out this study, official permission was obtained from the directors of Suez Canal University Hospital (SCUH). This was done by submission of a formal letter from the Vice Dean for Graduate Studies and Research of the Faculty of Nursing to them explaining the objectives of

the study. The director of SCUH resent study formal letter to both ICU coordinators and Staff Development and Training Unit for cooperation. Meeting and discussion were held between the researcher and ICU managers and nursing administrative personnel to make them aware about the aim of the study and objectives of the research, as well as to get better cooperation.

At the initial interview, each nurse and patient were informed about the nature, purpose and benefits of the study and informed that, his/her participation was voluntary. Confidentiality and anonymity of the subjects were also assured through coding of all data. The researcher assured that, the data collected, and information would be confidential. A written consent was obtained after explanation of the purpose of the study

3.0 RESULTS

The result of the current study presented that 42.6% of total studied ICU patients were at age group 51-65 years old and about half of them 55.3% were females' patients. The patients' total numbers of admissions were 352 day from hospitalization until discharge from ICU and 312 day for ICU only. Diabetes Mellitus (DM) was the most common comorbid diseases to be 63.8% among the studied populations followed by hypertension 40.4%. In relation to patients' discharge status from ICU, 40.4% died in ICU and 56.6% transferred to another hospital units after stabilizing their conditions as demonstrated in table 1.

Table 1: Percentage distribution of ICU patients' profile

Personal profiles of studied patients	Pretest		Correlation	
	N	%	r	p
Age				
21≥35	10	21.3		
36≥50	8	17	.178	.231
51≥65	20	42.6		
≥ 66	9	19.1		
Sex				
Male	21	44.7	.142	.341
Female	26	55.3		
Duration of hospital admission until discharge from ICU	352		.526	.000**
Duration of ICU admission	312		.510	.000**
Presence of co-morbid disease				
<input type="checkbox"/> Hypertension	19	40.4	.102	.496
<input type="checkbox"/> DM	30	63.8	.382	.008**
<input type="checkbox"/> Liver disorders	6	12.8	-.155	.297
<input type="checkbox"/> Kidney disorders	9	19.1	-.290	.848
<input type="checkbox"/> Immunosuppressed condition	4	8.5	.071	.636
Discharge status from ICU				
Transfer to another unit	28	59.6	.102	.496
Dead	19	40.4		

item was divided on total number of catheter days=312

*Significance at p-value= 0.05

r= correlation test

Table 2 concerning IUC assessment showed that about 40.4% of ICU patients had been inserted their IUC in emergency department, silicon elastomer coated latex was the most utilized IUC material type used for about 95.7% and 66% of ICU patients were placed with catheter size 18.

Table 2: Indwelling Urinary Catheter Assessment Data:

Assessment items	Pretest		CAUTI Occurrence	
	N	%	r	P
IUC insertion unit:				
ICU	7	14.9		
CCU	3	6.4		
IU	4	8.5	.016	.459
EU	19	40.4		
OR	12	25.5		
Another Hospital	3	2.12		
Material				
silicone-elastomer coated latex	45	95.7	.061	.343
silicone	2	4.3		
Size				
12	2	4.3		
14	1	2.1	.264	.036*
16	12	25.5		
18	31	66		
20	1	2.1		
Indication as expressed by ICU responsible nurse				
Monitoring of fluid balance	40	85.1		
Promote healing of sacral wound	7	14.9	.058	.349

*Significance at p-value= 0.05

r= correlation test

The findings showed that, most of the studied ICU patients had abnormal fluid balance 92.1% during their admission to ICU. Furthermore, 100% had placed IUC followed by 92.6% centerline as invasive tubes utilization rate as showed in table 3.

Table 3: Present health assessment of ICU patient

Present health assessment	CAUTI Occurrence			
	N	%	r	p
Frequency N. of abnormal vital signs				
HR	154	49.7	-.124	.406
RR	100	32.1	.336	.021*
BP systole	93	29.8	.036	.802
BP diastole	172	55.1	-.173	.245
Temperature	98	31.4	.108	.471
∞frequency N. of abnormal fluid balance	244	92.1	.483	.001**
Duration of Tubes connected to patient:				
Endotracheal tube	151	48.4	-.171	.251
Tracheostomy tube	22	7	.056	.709
Wound drainage	102	32.6	.170	.250
Centerline	289	92.6	.555	.000**
IUC	312	100	.510	.000**
Frequency of abnormal Urine clarity				
Cloudy	75	24	.357	.014*

*Significance at p-value= 0.05

r= correlation test

Regarding to CAUTI diagnosis criteria changing level of consciousness was founded the highest repeated sign of CAUTI 43.9%, followed by fever above 38[□] to be 30.1% and suprapubic tenderness 22.4% of the total IUC placement days. CAUTI was founded to be 54.48 per 1000 catheter day. Only decreasing level of consciousness was positively correlated with CAUTI occurrence as showed in table 4.

Table 4: CAUTI Diagnosis Criteria

CAUTI Diagnosis Criteria	CAUTI Occurrence			
	N	%	R	P
Total number of CAUTI Symptoms days:				
<input type="checkbox"/> Suprapubic tenderness	70	22.4	.173	.244
<input type="checkbox"/> CV angle tenderness	8	2.5	.197	.185
<input type="checkbox"/> Fever \geq 38	94	30.1	-.131	.381
<input type="checkbox"/> LOC	137	43.9	.374	.010*
♦Total Urine culture	45	14.4		
∞Unjustified urine culture done in the ICU	8	17.7		
CAUTI Rate	17	36.1		
Transfer CAUTI	6	12.7		
CAUTI per 1000 catheter days	54.48			

item was divided on total number of catheter days=312

♦Total number on patients performed urine cultures

∞ divided on

*Significance at p-value= 0.05

r= correlation test

Concerning IUC maintenance care provided by the nurses, the most pitfalls observed were regarding perineal care and IUC care to be 97.8% of total IUC days. Followed by, unsecured IUC to patient's body according to patient's sex to be about 95.5% of total IUC days. Besides that, nurses founded to open IUC close system by about 20.1% to; measure intra-abdominal pressure, irrigate IUC and collect a urine culture specimen as revealed in table 5.

Table 5: distribution of Nurses IUC Maintenance Care Total Days were (n=312).

Frequency of IUC Maintenance Care	n	%	r	p
Unsecured IUC in place	298	95.5	.526	.000**
Securement IUC incorrectly	302	96.7	.517	.000**
Obstructed IUC tube	34	10.8	.543	.000**
Incorrect urinary bag placement (above the bladder)	11	3.5	-.198	.183
IUC bag on the floor	27	8.6	.145	.330
Container over filled	16	5.1	.176	.237
Break catheter seal	63	20.1	.247	.094
Ignoring Perineal care	305	97.8	-.019	.898
Total number of IUC changes	10	3.2	.055	.713

*Significance at p-value= 0.05

r= correlation test

Catheter associated urinary tract infection founded to be correlated positively with total days of hospital admission at p-value = .000 for both. According to patient history of comorbid diseases, only DM was noticed to be positively correlated with CAUTI occurrence at p-value =.008. During ICU admission patient's abnormal fluid balance, increase duration of IUC insertion and centerline venous catheter and development of cloudy urine were correlated positively with development of CAUTI at p-value= 001, .000, and .014 respectively.

IUC size represented a positive significant correlation between larger IUC size and CAUTI occurrence at p-value =.036. Nurses practice toward IUC maintenance founded to be positively correlated to CAUTI occurrence including; either incorrect securement or unsecured IUC totally and obstructed IUC tube at p-value =.000.

Discussion

The present study portrayed a high CAUTI rate to be more than half per thousand catheter day. This was agreed with a study conducted in rural area "Kafr El Dawar" where CAUTI rate was 90.6 per 1000 catheter day, explaining this high incidence to poor of availability of sterile supplies and infection control programs [8]. This incidence was close to a study conducted in India reported CAUTI rate to be 36.2 /1000 catheter day [20].

In the other side CAUTI incidence rate in developed country like USA was between 1- 0.56 /1000 catheter day [3]. In Europe a surveillance report conducted through European centers for disease prevention and control (ECDC) including 17 European nations for all HAI and mortality associated to CAUTI in ICUs, the CAUTI incidence per 1000 catheter day was 3 ranged between 1.0-5.8 [21]. From this finding the researcher could confirm that CAUTI rate differed obviously through developing countries than in developed one [22], [23].

Furthermore, CAUTI incidence could be differed in the same country. This could explain why the incidence of CAUTI in this study was higher than another study conducted in Egypt. For example, a study conducted in Zagazig University Hospital ICUs demonstrated CAUTI incidence to be 10.6/1000 IUC day [24]. Another study conducted in Egypt, specifically in Cairo University Hospital, identifying impact of CAUTI preventive bundle in ICU, showed CAUTI incidence to be 18.09 as a base line data [25]. Finally, a national survey conducted in Egypt measuring CAUTI and common pathogens prevalence in twenty eight hospitals ICUs to be 1.9 /1000 catheters day [9]. This obvious difference could be explained by report released by CDC in 2009, that CAUTI incidence difference in USA was about thirty five folds according to healthcare setting and location [26].

The current study showed a nonsignificant correlation with the patient's suprapubic tenderness. This result was contradicted a study performed on USA about long term used IUC, reported a significant relation between CAUTI occurrence and suprapubic tenderness [27].

In the other a review article in India mentioned that ICU patient had a special circumstance that hinder monitoring of CAUTI diagnosis according to CDC criteria. For example, patient in ICU is commonly connected with endotracheal tube that eliminate patient ability to communicate tenderness [28]. In my point of view suprapubic tenderness was distracted by abdominal surgical site with wound drainage that was about five-fold during pretest compared only seven during post-test group especially for female patients with hysterectomy.

Factors Affecting CAUTI Rate:

Both days of hospitalization and ICU admission was founded to be positively affecting CAUTI occurrence. This data was agreed with [29] in Thailand through a stud reported that patient duration of hospitalization before admission ICU influence patient to acquire CAUTI.

Concerning to IUC utilization rate all the studied patient sample was catheterized during ICU admission with a significant correlation to CAUTI occurrence. This finding was in harmony with a study conducted in Korea reported high incidence of IUC utilization for urinary output monitoring and notified that it is not a justified indication for IUC catheterization during ICU admission. Besides that, expressing that IUC placement duration was founded to be correlated positively with CAUTI occurrence [30]. The study anticipated that early removal of IUC using reminder system or nurse driven protocol would enhance results.

Regarding to chronic comorbid that could influence CAUTI incidence more than two third of the studied patients had DM, that founded to be correlated with CAUTI occurrence incidence. This agreed with studies conducted in USA India, and Korea, expressed DM to be a risk factor for CAUTI development [31] [32] [33]. This could be explained by the fact that DM accelerates many types of diseases progression. From this finding reports, the researcher could confirm that diabetic patient is more prone to HAI and CAUTI and need a special precaution and attention during care.

In relation to IUC monitoring data, the result of the current study showed a negative strong significant correlation between CAUTI occurrence with each of secured IUC in place, correct IUC securement and obstructed IUC tube. This result agreed with the CAUTI preventive

guidelines for proper IUC securement to patients body and avoidance of its obstruction [14]. In contrary a control randomized trial showed no significant relation between IUC securement and CAUTI occurrence [34].

4.0 CONCLUSION AND RECOMMENDATIONS:

Conclusions

This study deduced that CAUTI occurrence rate differs according to healthcare setting and location. CAUTI was founded to be correlated positively with the duration of hospital admission, IUC utilization and nursing IUC maintenance care malpractices. Patients with DM as a comorbid disease were more prone to develop CAUTI.

Recommendations

The present study recommends; enhancing early removal of IUC when no longer needed by application of reminding systems and nurse-driven protocol, use IUC alternatives to manage urinary incontinence and monitoring of urinary output, and implement CAUTI preventive bundles regarding IUC securement to the patient's body and to keep IUC tube patency.

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