

Efficacy of Protocol of Hygienic Care by Chlorhexidine Gluconate on the Occurrence of Catheter Associated Urinary Tract Infection among Critical Ill Patients

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Abstract

Catheter-associated urinary tract infections (CAUTIs) is the most common type of hospital acquired infection in Intensive Care Units. It is associated with significant morbidity, length of hospital stay and cost of hospitalization. Preventing CAUTI is essential and critical care nurses are the key to accomplishing this goal. **Aim:** - evaluate the efficacy of protocol of hygienic care by chlorhexidine gluconate on the occurrence of a catheter associated urinary tract infection among critically ill patients. **Design and setting:** - A quasi-experimental study was conducted at the Neurological Intensive Care Unit of both Tanta University Hospital and Neuro-psychiatry center at Tanta Main University Hospital. A convenience sampling of 60 adult patients with indwelling urinary catheters were selected and divided into two equal groups 30 patients in each group. **Group 1:-** (Control group), they received routine nursing care by hospital nursing staff. **Group 2:-** (Study group), they received application of protocol of hygienic care by chlorhexidine gluconate 2%. Three tools were used for data collection. **Tool (I)** Assessment tool which included Patient's socio-demographic characteristics. **Tool (II): Catheter Associated Urinary Tract Infection Assessment Profile (CAP):-**. **Tool (III): Infection Assessment Sheet: -**. **Results:** - The main results revealed that the incidence rate of CAUTI among control group subjects was 93.33% while among study group subjects was 40.00%. **Conclusions and recommendations:** - Application of protocol of daily Hygienic Care by Chlorhexidine Gluconate has a significance effectiveness on reducing CAUTI among critically ill patients. It was recommended that all critically ill patients with indwelling urinary catheter in ICU should receive daily Hygienic Care by Chlorhexidine Gluconate as routine of care.

Key words: Catheter-associated urinary tract infections, chlorhexidine gluconate 2%, daily bathing

Introduction

Health care-associated infections (HAIs) are the type of infection that are acquired from hospitals after the second day of admission. It is estimated that up to 80% of all hospital deaths are directly or indirectly related to HAIs⁽¹⁾. Health care-associated infections acquired in Intensive Care Units (ICUs). This is of pronounced significance among critically ill patients related to many factors such as prolonged use of multiple invasive equipment⁽²⁾ CAUTI represent the third-leading cause of infections in the Intensive Care Units worldwide after pneumonia and abdominal infections⁽³⁾.

Catheter acquired urinary tract infection is one of the most common health care acquired infections among critically ill patients in ICU. Approximately 12%-16% of adult hospital inpatients will have an indwelling urinary catheter (IUC) during their hospitalization, and each day the indwelling urinary catheter remains, a patient has a 3%-7% increased risk of acquiring (CAUTI)⁽⁴⁾. In Egypt, surveillance was done in Intensive Care Units at Cairo University at April 2020. Its results revealed that total of 2022 patients were hospitalized in ICUs and acquired length of hospital stay more than 15 days.⁽⁵⁾

Catheter-associated urinary tract infection is defined as a urinary tract infection that occurs among patients with an indwelling urinary catheter, where was in place for >2 days, at least one of the following signs or symptoms: fever (>38.0°C, suprapubic tenderness ,costovertebral angle pain or tenderness ,urinary urgency ,urinary frequency ,dysuria , Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of $\geq 10^5$ CFU/ml⁽⁶⁾

Several strategies have been used by healthcare specialists to deal with and prevent the risk of CA-UTIs among critically ill patients. These methods include hand hygiene practices, methods of handling indwelling catheter, urine collecting system.appropriately, securing catheter properly, maintaining unobstructed urine flow and closed sterile drainage system, However, the application of antiseptic chlorhexidine gluconate 2% bathing for the critically ill patients is the most proper method for controlling the source of CAUTIs infection.⁽⁷⁾

Daily Chlorhexidine gluconate 2% bathing during hygienic care in the ICU can prevent catheter associated urinary tract infection and become standard of care in most ICUs and are incorporated into many experts

guidelines⁽⁸⁾ Chlorhexidine has a broad-spectrum activity against gram-positive and gram-negative bacteria, yeasts, and some lipid enveloped viruses. Potent sporicidal activity can be induced in chlorhexidine under altered physical and chemical conditions (eg, elevated temperature, altered pH, and addition of ethanol). However, chlorhexidine does not have activity against bacterial spores under the conditions present on skin. Due to its broad-spectrum antimicrobial activity and excellent safety profile, chlorhexidine is used in a wide variety of disinfectant, antiseptic, and preservative applications⁽⁹⁾

Critical care nurses are in the best positioned for CAUTI prevention among critically ill, by selecting of the optimal catheters and drainage systems, using strict aseptic technique during insertion of the suitable catheter, securing catheter to prevent movement, performing daily perineal care by using chlorhexidine gluconate 2%, maintaining a closed drainage system, obtain urine specimen for culture at the first sign of infection and perform daily chlorhexidine gluconate 2%, bathing. Also, reducing the catheter days by daily evaluation of the need for continuing an indwelling catheter and removal of the catheter whenever possible and use of

alternative method of bladder drainage (e.g. septic intermittent catheterization or use of external urine collection devices).⁽¹⁰⁾

The use of daily CHG bathing in intensive care patients has been advocated to reduce many of the infections in critically ill patients. However, the effectiveness of CHG bathing to reduce ICU infections has varied considerably among published trials, making the effectiveness of CHG bathing in ICU patients uncertain. This variability has been suggested to be associated with the underlying risk of infection among The ICU patients included in the various trials, with the greatest benefit observed among patients with the highest prevalence of infection at baseline. Therefore, there's a great effectiveness of CHG bathing among adult intensive care patients in reducing various infections in the ICU bloodstream infections (BSI); central line-associated bloodstream infections (CLABSI), (CAUTI) and ventilator-associated pneumonia (VAP).⁽¹¹⁾

Key guidelines for prevention of catheter-associated urinary tract infection include placement of indwelling urinary catheters for appropriate indications, using alternatives to indwelling catheterization and using aseptic technique during insertion, One element of correct insertion practices is cleaning of the urethral meatus prior to catheterization by

using chlorhexidine gluconate 2% and early removal of indwelling catheters.⁽¹²⁾ Catheter associated urinary tract infection prevention guidelines can reduce catheter associated urinary tract infection rates in ICU. Therefore, the present study is an attempt to increase awareness about the effect of the use of daily CHG bathing among critically ill patient have major effectiveness on reduction of catheter associated urinary tract infection.

Significance of the study: CAUTI is the most common type of hospital acquired infection among critically ill patients. So that there were different methods for prevention of incidence of CAUTI before, during and after urinary catheter insertion. This carried out through maintenance aseptic technique, perineal care and performing daily bathing ongoing catheter care by chlorhexidine Gluconate 2 %. It was implemented on all critically ill patients of neurological ICU at Tanta university hospitals. The use of chlorhexidine for routine urinary catheter care and daily bathing for patients with urinary catheters may significantly decrease catheter-associated urinary tract infections.

Aim of the study

Evaluate the efficacy of protocol of hygienic care by chlorhexidine gluconate on

the occurrence of catheter associated urinary tract infection among critical ill patients.

Research Hypothesis

The following research hypothesis was formulated in an attempt to achieve the aim of the study: Critically ill Patients in the Intensive Care Unit expected to have minimal catheter associated urinary tract infection post implementation of protocol of hygienic care by chlorhexidine gluconate.

Subjects and methods

A quasi- experimental research design was utilized to conduct the study.

Setting

The study was conducted at the Neurological Intensive Care Unit of both Tanta University Hospital and Neuro-psychiatry Center at Tanta Main University Hospital.

Subjects

A convenience sampling of (60) critically ill patients in the above previously mentioned settings was included. The sample size was calculated based on Epidemiological Information Program, based on the total patients per year according to review of Tanta Main University Hospital statistical Records. They were divided into two equal groups; each group were consisted of (30) patients as following:

Group (1): Study group, it was consisted of (30) patients, who received protocol care according to hygienic care by chlorohexidine gluconate 2% that was implemented by the researcher.

Group (2): Control group, it was consisted of (30) patients and **there** are received their routine care in the Intensive Care Units by nursing staff. Such as daily bathing with water and soap.

The following criteria were used for selecting sample: -

Inclusion Criteria

- Newly admitted patients.
- Patients who fixed a urinary catheter during their hospital stay.

Exclusion Criteria:

- Patients with a known allergy or hypersensitivity to CHG.
- Patients with chronic, severe and generalized skin abnormalities.
- Patients with a previous or current urinary tract infection.
- Patients with positive urine culture at the onset of catheterization.
- patients with diabetes mellitus, cancer and recent surgery.

Tools of data collection

Three tools were used to evaluate the efficacy of protocol of hygienic care by chlorhexidine gluconate on the occurrence of

a catheter associated urinary tract infection among critically ill patients, which includes the following:

Tool (I): Structural Clinical Assessment Tool

It was comprised of two parts:-

Part (1): Socio-demographic characteristics of patients: which included; patient' code, age, sex, marital status, occupation, level of educational and Place of residency.

Part (B): Patients' clinical data: - It was developed by the researcher based on literature review ⁽¹³⁾ ,to evaluate patients' clinical data regarding; current diagnosis, weight, height, date of admission, previous admission to ICU, chief complaint and present history, past medical and surgical history, allergic history, duration of disease, types of treatment, reasons for catheter insertion, catheter size, medications that had been prescribed and laboratory investigation.

Tool (II): Catheter Associated Urinary Tract Infection Assessment Profile (CAP)

Catheter associated urinary tract infection Assessment Profile was developed by **Inouye et al.,(1990)**⁽¹⁴⁻¹⁶⁾ to measure the presence or absence of the following clinical symptoms of CUTI through physical examination ; fever, suprapubic tenderness,

flank tenderness, and delirium at pre, one week and two week post implementation of protocol of hygienic care by chlorhexidine gluconate. The catheter assessment profile tool contains definitions of each clinical sign and symptom as well as diagrams, to aid in their consistent assessment. **Scoring system:** It was scored as the following; (0) indicate absence of clinical symptoms and (1) indicate presence of clinical symptom.

Tool (III): Infection Assessment Sheet

It comprised of two parts:

Part (I): Catheter Urinary Tract Infection Assessment Sheet

Catheter urinary tract infection assessment sheet was developed by the researcher based on literature review⁽¹⁷⁻¹⁹⁾. It was used for indicating the systemic and local signs of infection at pre, one week and two week post implementation of protocol of hygienic care by chlorhexidine gluconate as the following;

-Systemic signs of infection which included; fever, chills, inflammation, swelling, allergy, urticaria, pain, discomfort, acute change in mental status and increase WBCs in the blood.

-Local signs of infection which included; turbid urine, dysuria, hematuria, bad odour, purulent discharge from catheter site, nocturia, redness near the catheter site, pain

near the catheter site and an increase of WBCs in urine. **Scoring system:** it was scored as the following; (0) indicate absence of symptoms and (1) indicate presence of symptom.

Part (II): Laboratory Investigations; the researcher utilize specific laboratory investigations to assess presence of urinary catheter infection as, urine analysis to detect incidence of bacteria, white blood cells, R.B.Cs, nitrites, proteinuria, glycosuria, ketonuria, and renal calculi in urine sample, urine culture for isolation of different organisms and blood culture for bacteremia.

Ethical and legal consideration

- Permission to conduct the study was obtained from the directors of the both Neurological Intensive Care Unit of both Tanta University Hospital and Neuro-psychiatry center at Tanta Main University Hospital.

An informed consent was taken from every conscious patient or his relatives after explanation the aim of the study.

-Confidentiality and privacy were taken into consideration a regarding data collection .A code number was used instead of names.

Methods of data collection

-All tools of the study were developed by the researcher after reviewing relevant

literature⁽¹⁹⁻²⁰⁾) to collect data except **Catheter associated urinary tract infection Assessment Profile** that was developed by **Inouye et al.,(1990).**⁽¹⁴⁻¹⁶⁾

- The developed tools were tested for content validity and clarity of questionnaire by nine experts in the Medical Surgical Nursing Critical Care Nursing and Neurological field professors and accordingly needed modifications were done. It was calculated and found to be =97%

-All tools of the study were tested for reliability by using alpha Cronbach's test and found to be 0.896, 0.868, and 0.831 respectively for the tool I, II, III which represent highly reliable tools.

-pilot study was conducted before the actual study on (10%)of the patients, to test the clarity, feasibility; relevance and applicability of the different items of the tools to determine any obstacles that may encountered during the period of data collection , accordingly needed modifications were done before the main study . The **pilot study** was excluded from the original study subject.

-Data were collected over a period of 8 months, started from March 2020 to october2020.

-The present study was conducted through four phases (assessment, planning,

implementation and evaluation phase) and it was continued for each patient individually till the end of intervention of hygienic care period.

1. Assessment phase

Assessment of the baseline data for critically ill patients was carried immediately once within admission to the ICU and for 15days of protocol of hygienic care by chlorohixidine gluconate 2%.by using tool (I) part I and part II, Tool II and Tool III used by the researcher for all patients in the study and control groups to assess the patients who meet the inclusion criteria and will be included in the study. The assessment phase includes the following: Assessment sociodemographic data and clinical data, Assessment of presence of Catheter Associated Urinary Tract Infection by using Tool (II) Catheter Associated Urinary Tract Infection Assessment Profile (CAP)and Assessment of signs and symptoms of CAUTI by using Tool (III) Catheter Urinary Tract Infection Assessment Sheet:

2. Planning phase

The protocol of hygienic care by chlorohexidine gluconate 2% was planned based on the study subjects' needs and literature review.

- The general objective of the care was to reduce the occurrence of catheter associated urinary tract infection among critically ill patient.

- The specific objectives of the study were decrease signs and symptoms of catheter associated infection as fever, flank pain, suprapubic tenderness, interpret the required care to be provided in case of appearance of any complications.

-Preparing the content of the protocol of hygienic care; the content was prepared by the researcher according to literature review (20-22) to meet the above mentioned specific objectives. An illustrative structured colored booklet was prepared.

-The hygienic care was carried out in (2) basic phases individually for every patient as following: Phase 1: was carried out at the beginning of care to insert catheter and during any time will be determined to replace urinary catheter. Phase 2: was carried out every day through performing daily use of chlorohexidine gluconate 2% for the patients. The time of phases was detected according to the condition of the patients.

Implementation phase

- A protocol of hygienic care by daily chlorhexidine gluconate was carried out by

the researcher for the study subjects throughout the following phases:-

-Phase (1):- Assessment of the patients and catheter insertion phase

It was implemented by the researcher, this phase take about 30 minutes and include the following:

- Assess the perineum area of the patient on the admission to the hospital for detecting; skin irritation, skin breakdown, allergy, any abnormal signs and symptoms of infection as fever, inflammation, and swelling, leakage of urine, pain, bad odor and redness.

- Choice of catheter size according to patients' weight.

-Application of infection control measures by using aseptic technique during insertion of catheter.

-Clean of the perineum area of the patients before catheter insertion by chlorohexidine gluconate 2% then during insertion and maintenance to prevent catheter associated urinary tract infection.

-Insert urinary catheter for the patients according to specific procedure.

-Aspirate 3 ml of urine from the sampling port of the catheter.

-Take urine culture at the time of catheterization to be sure that patients are free from urinary catheter infection.

-Phase (2); Application of Daily Chlorhexidine Gluconate 2% for 14 days:

it included the following: - Reassess the perineum area of patient daily.

- Application of infection control measures by using aseptic technique.

- If patient' skin is extremely soiled, give a bath with soap and water first, Remedy skin cleanser by using a clean cloth for each skin area. Skin contamination with blood, secretions or faeces occurring will be removed using CHG 2% solution.

- Hygienic care with daily chlorhexidine gluconate 2% was performed every morning shift at a detected time for 14 days for every patient. CHG 2% was prepared with diluted solution with equal amounts of warm tap water in clean basine with wash cloth.

- Hygienic care was carried out as the following; Assess and clean of perineum area, thigh, abdomen by CHG 2%, clean around/ below the catheter, clean sterile closed system, empty of the drainage bag and clean it, catheter change if needed, check catheter patency, ensure position of drainage tube & bag and frequent observation of urine character (color, odor and consistency). After completing the procedure, the skin was not rinsed, no liquids, moisturising lotion or other care cosmetics was not applied.

- Daily review of the need to maintain the catheter, removal of it as soon as possible.

- **Control group** were received the routine nursing care provided to the patients by nurses in the Neurological Intensive Care Unit of Tanta Main University Hospital which includes; clean perineum area with soap and water, clean area with betadine solution.

4. Evaluation phase

- Every patient in both groups (study and control) was assessed as the following:-

-Tool I: before implementation of protocol of hygienic care by chlorhexidine gluconate to assess baseline data for patients. **- Tool II:** was used pre, one week and two week post implementation of protocol of hygienic care by chlorhexidine gluconate.

Methods of data analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 26. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, comparison was done using Chi-square test (χ^2). For comparison between means of variables for two groups, independent samples T-test was used. For comparison between means for variables pre and post intervention in a group, paired samples T-test was used. For

comparison between means for variables during three periods of intervention in a group, or for more than two variables, the F-value of analysis of variance (ANOVA) was calculated. Correlation between variables was evaluated using Pearson and Spearman's correlation coefficient r . A significance was adopted at $P < 0.05$ for interpretation of results of tests of significance (*). Also, a highly significance was adopted at $P < 0.01$ for interpretation of results of tests of significance (**).⁽²³⁾

Results

Table (1): Distribution of the studied patients according to their socio-demographic characteristics among the studied groups. The results revealed that more than one third of the patients in both control and study groups (43.33% and 30.33 %) respectively were between (40-<50) years old, with a mean age of (41.53 ± 8.63) in the control group and 41.47 ± 8.73 in the study group. **In relation to sex**, more than half of the patients in the control and study groups were male (63.33% and 53.33 % respectively), **Concerning marital status**, more than one third of the patients in the control and study groups 40.00% and 36.67% respectively were married. **Regarding educational level**, Nearly one quarter of studied patients in the control and

study group had secondary education. **As regard to occupation**, it was observed that less than half of the patients in control and study groups were (30.00% and 40.0%) respectively were not working.

Table (2): Show distribution of the studied patients according to their clinical data among the studied groups concerning their Current diagnosis. Our results showed that about one third of patient in control and study groups (33.33 % and 30.00%) respectively had hemorrhagic stroke. **Concerning BMI**, more than one third of the patients in both control and study groups (36.67% and 30 % respectively) were overweight. The mean duration of previous admission was 4.60 ± 1.17 and 4.07 ± 1.06 days in control and study groups respectively with no statistical significant difference between the two groups.

Table (3) illustrates distribution of the studied patients in the control and study groups according to urinary catheter assessment data. The results revealed that most of the patients in both control and study groups (70.00% and 93.33%) respectively catheterized due to limited mobility, followed by (70.00% of both groups catheterized for measuring urinary output. Concerning size of the catheter, most

of the patients in the control and study groups (46.67% and 43.33%) respectively were catheterized with 16 Fr catheter size.

Table (4) shows distribution of the studied patients according to their total level of catheter associated urinary tract infection assessment profile throughout periods of study. The results revealed that(70%) of the patients in the control group had severe symptoms **after 2 weeks** as compared to (13.33%) of the patients in study group **after 2 weeks** of protocol. With mean (3.53±0.900) and (1.17±1.416) in control and study group respectively after 2 weeks.

Table (5): Distribution of the studied patients according to total level catheter associated urinary tract infection about local UTI manifestations throughout periods of study. The results revealed that (86.67%) of the patients in control group had severe symptoms **after 2 weeks** as compared to (6.67%) of the patients in study group **after 2 weeks** of protocol of care, with the mean (5.30±0.702) and (1.63±1.586) in control and study group respectively after 2 weeks of protocol of care. **Table (6) Distribution of the studied patients according to their total level of catheter associated urinary tract infection about systemic manifestations throughout periods of study.** The results revealed that

(63.33%) of the patients in control group had **after 2 weeks** as compared to (10.0%) of the patients in study group had severe symptoms **after 2 weeks** of protocol of care. With the mean of (5.83±0.986) and (1.93±2.016) in control and study group respectively after 2 weeks of protocol of care.

Table (7) presents Mean scores of blood chemistry items among the studied groups throughout periods of study. The results revealed that the mean of serum leukocytes count was (14.45±2.39) and (10.82±1.86) in the control and study group respectively **after 2 weeks** of protocol of care. The mean CRP level was (77.07±6.41) and (37.33±2.64) in control and study group respectively **after 2 weeks** of protocol of care.

Table (8) Show distribution of the studied patients according to urine culture throughout periods of study. Regarding colony count, it was found that the majority (80.00%)of patients in the control group had colony count (>100,000) as compared to (20.00%) of the patients in study group had colony count (>100,000) after 2weeks of protocol of care. **In relation to types of microorganisms,** this table showed at the end of second week that, E-coli was the commonest pathogen in control group

(30.00%) followed by Klebsiella (16.67%), Staphylococci (16.67%), Enterobacter (10.00%) and Pseudomonas (6.67%). On the other hand, Staphylococci was the

Table (9) Correlation between catheters associated urinary tract infection assessment profile CAP, local UTI manifestations and systemic manifestations levels of the studied patients among the studied groups throughout periods of study. The table shows that CAP level had statistically significant positive correlation with UTI manifestations ($r= 0.379$, $p= 0.039$) pre care in control group while in the study group, CAP level had statistically significant correlation with UTI manifestation at the end of first week ($r= 0.542$, $p= 0.002$) and at the end of second week ($r= 0.444$, $p= 0.014$).

Catheters associated urinary tract infection assessment profile level had statistically significant positive correlation with systemic manifestation at the end of first week ($r= 0.453$, $p= 0.012$) and at the

commonest pathogen in study group (13.33%) followed by E-coli (3.33%), also Klebsiella (3.33%) and lastly Enterobacter (0.00%).

end of second week ($r= 0.582$, $p= 0.001$) in the control group.

Table (10) Correlation between catheter associated urinary tract infection assessment profile and sociodemographic characteristics of the studied patients among the studied groups throughout periods of study. There was no significant correlation between CAP and age in control and study group. In relation to gender there was a positive significant correlation between CAP and gender (femal gender) ($r=0.438$ $p=0.016$) in pre care, while there was no significant correlation at the end of two weeks. On the other hand no significant correlation was observed regarding level of education, residence, body mass index and prognosis with CAP.

Table (1): Distribution of the studied patients according to their socio-demographic characteristics.

Characteristics	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Age (in years)					
<20	1	3.33	0	0.00	2.476 0.649
(20-<30)	3	10.00	4	13.33	
(30-<40)	7	23.33	10	33.33	
(40-<50)	13	43.33	9	30.00	
≥ 50	6	20.00	7	23.33	
Range	(19-54)		(22-53)		t=0.030
Mean \pm SD	41.53\pm8.63		41.47\pm8.73		P=0.976
Gender					
Male	19	63.33	16	53.33	FE 0.601
Female	11	36.67	14	46.67	
Marital status					
Married	12	40.00	11	36.67	0.454 0.929
Single	6	20.00	6	20.00	
Divorced	5	16.67	7	23.33	
Widow	7	23.33	6	20.00	
Educational level/					
Illiterate	7	23.33	5	16.67	0.501 0.973
Read and write	6	20.00	6	20.00	
Primary education	5	16.67	6	20.00	
Secondary education	6	20.00	7	23.33	
University educated	6	20.00	6	20.00	
Occupation					
Not work	9	30.00	12	40.00	1.275 0.735
Employee	8	26.67	5	16.67	
Manual work	7	23.33	6	20.00	
House wife	6	20.00	7	23.33	
Residence					
Rural	15	50.00	16	53.33	FE 1.00
Urban	15	50.00	14	46.67	

* Significant at level $P < 0.05$.

Table (2): Percent distribution of the studied patients(control &study group) according to their clinical data.

Clinical data	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Current diagnosis					
Brain stem infraction	2	6.67	4	13.33	0.862 0.973
Gullian barre syndrome	4	13.33	3	10.00	
Hemorrhage stroke	10	33.33	9	30.00	
Ischemic stroke	7	23.33	7	23.33	
Mythenia gravies	4	13.33	4	13.33	
Seizures	3	10.00	3	10.00	
Weight (in kg)					
Range	(49-112)		(55-120)		t=0.723
Mean ± SD	78.13±2.92		81.20±3.08		P=0.473
Height (in cm)					
Range	(148-186)		(160-186)		t=0.658
Mean ± SD	168.33±7.63		169.43±5.06		P=0.513
Body mass index					
Under weight (<18.5)	2	6.67	0	0.00	2.842 0.724
Normal (18.5-<25)	7	23.33	9	30.00	
Overweight (25-<30)	11	36.67	9	30.00	
Obese Class I (30-<35)	8	26.67	9	30.00	
Obese Class II (35-<40)	1	3.33	1	3.33	
Obese Class III (≥40)	1	3.33	2	6.67	
Range	(16.51-43.75)		(19.49-42.52)		t=0.420
Mean ± SD	27.66±5.83		28.2910±5.81		P=0.676
Duration of previous admission (in days)					
Range	(0-19)		(0-17)		t=0.338
Mean ± SD	4.60±1.17		4.07±1.06		P=0.737
Prognosis					
None	20	66.67	17	56.67	1.243 0.537
Decline	3	10.00	6	20.00	
Get better	7	23.33	7	23.33	

* Significant at level P < 0.05.

Table (3): Percent distribution of the studied patients(control &study group) according to reason of catheterization and its size.

Catheterization	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
# Reason of catheterization					
In critically ill patients to monitor urinary output	21	70.00	21	70.00	5.455 0.042*
Bed ridden patient	21	70.00	28	93.33	
Urine retention and obstruction of urine out flow	6	20.00	4	13.33	
Post-operative drainage in surgical operation	5	16.67	9	30.00	
Acute urinary incontinence	17	56.67	21	70.00	
Cather size					
14 Fr	5	16.67	3	10.00	1.256 0.740
16 Fr	14	46.67	13	43.33	
18 Fr	9	30.00	10	33.33	
20 Fr	2	6.67	4	13.33	

* Significant at level P < 0.05.

Table (4) Distribution of the studied patients according to their total level of catheter associated urinary tract infection assessment profile throughout periods of study.

CAP items	The studied patients (n=60)												χ^2 P	
	Control group (n=30)						χ^2 P	Study group (n=30)						
	Pre care		After a week		After 2 weeks			Pre care		After a week		After 2 weeks		
	N	%	N	%	N	%		N	%	N	%	N		%
Total CAP level													85.59 0.000*	
No symptoms (0)	27	90.00	1	3.33	1	3.33	30	100.00	14	46.67	14	46.67		
Mild (1-2)	3	10.00	8	26.67	2	6.67	0	0.00	12	40.00	11	36.67		
Moderate (3)	0	0.00	12	40.00	6	20.00	0	0.00	0	0.00	1	3.33		
Severe (4)	0	0.00	9	30.00	21	70.00	0	0.00	4	13.33	4	13.33		
Range	(0-2)		(0-4)		(0-4)		F=138.47	(0-0)		(0-4)		(0-4)		F=9.92
Mean ± SD	0.17±0.531		2.90±0.995		3.53±0.900		P=0.00*	0.00±0.00		1.10±1.373		1.17±1.416		P=0.00*

* Significant at level P < 0.05.

Table (5) Distribution of the studied patients according to total level catheter associated urinary tract infection about local UTI manifestations throughout periods of study.

UTI Manifestations	The studied patients (n=60)												χ^2 P	
	Control group (n=30)						χ^2 P	Study group (n=30)						
	Pre care		After a week		After 2 weeks			Pre care		After a week		After 2 weeks		
	N	%	N	%	N	%		N	%	N	%	N		%
Total UTI level														
Mild (0-2)	30	100.00	4	13.33	0	0.00	102.48 0.000*	30	100.00	23	76.67	22	73.33	9.92 0.042*
Moderate (3-4)	0	0.00	18	60.00	4	13.33		0	0.00	4	13.33	6	20.00	
Severe (5-6)	0	0.00	8	26.67	26	86.67		0	0.00	3	10.00	2	6.67	
Range	(0-1)		(0-6)		(4-6)		F=233.65	(0-0)		(0-6)		(0-5)		F=13.14
Mean ± SD	0.20±0.407		3.67±1.398		5.30±0.702		P=0.000*	0.00±0.00		1.47±1.737		1.63±1.586		P=0.00*

* Significant at level P < 0.05.

Table (6) Distribution of the studied patients(control &study group) according to their total level of catheter associated urinary tract infection about systemic manifestations throughout periods of study.

Systemic manifestations	The studied patients (n=60)												χ^2 P	
	Control group (n=30)						χ^2 P	Study group (n=30)						
	Pre care		After a week		After 2 weeks			Pre care		After a week		After 2 weeks		
	N	%	N	%	N	%		N	%	N	%	N		%
Total Systemic manifestations level														
Mild(0-2)	30	100.00	6	20.00	0	0.00	81.67 0.000*	30	100.00	23	76.67	20	66.67	11.46 0.022*
Moderate (3-5)	0	0.00	18	60.00	11	36.67		0	0.00	5	16.67	7	23.33	
Severe (6-7)	0	0.00	6	20.00	19	63.33		0	0.00	2	6.67	3	10.00	
Range	(0-1)		(1-7)		(4-7)		F=201.91	(0-0)		(0-7)		(0-7)		F=13.11
Mean ± SD	0.07±0.254		4.13±1.697		5.83±0.986		P=0.00*	0.00±0.00		1.67±1.863		1.93±2.016		P=0.00*

* Significant at level P < 0.05.

Table (7) Mean scores of blood chemistry items among the studied groups throughout periods of study.

Blood chemistry	The studied patients (n=60)							
	Range							
	Mean ± SD							
	Control group (n=30)			F P	Study group (n=30)			F P
Pre care	After a week	After 2 weeks	Pre care		After a week	After 2 weeks		
Serum Leukocytes count (×10³)	(6.750-10.58) 8.48±0.91	(8.200-14.00) 11.37±1.57	(10.000-18.00) 14.45±2.39	F=87.01 P=0.00*	(8.00-10.00) 8.37±0.46	(8.50-15.00) 10.63±1.65	(8.100-15.00) 10.82±1.86	F=26.63 P=0.00*
CRP (mg/l)	(-6-(-3)) -4.60±1.27	(-6-97) 33.03±5.34	(23-140) 77.07±6.41		F=71.92 P=0.00*	(-6-(-3)) -4.93±1.12	(-6-40) 14.17±2.39	

* Significant at level P < 0.05 .

Table (8) Distribution of the studied patients according to urine culture throughout periods of study.

Urine culture	The studied patients (n=60)													χ^2 P
	Control group (n=30)						χ^2 P	Study group (n=30)						
	Pre care		After a week		After 2 weeks			Pre care		After a week		After 2 weeks		
	N	%	N	%	N	%		N	%	N	%	N	%	
1.Colony count/ml														
None	0	0.00	2	6.67	2	6.67	97.22 0.000*	30	100.00	4	13.33	6	20.00	65.78 0.000*
Sterile	27	90.00	1	3.33	0	0.00		0	0.00	15	50.00	12	40.00	
<10,000	3	10.00	4	13.33	0	0.00		0	0.00	0	0.00	2	6.67	
(10,000-100,000)	0	0.00	13	43.33	4	13.33		0	0.00	9	30.00	4	13.33	
>100,000	0	0.00	10	33.33	24	80.00		0	0.00	2	6.67	6	20.00	
2.postive Microorganisms														
None	30	100.00	6	20.00	4	13.33	57.42 0.000*	30	100.00	21	70.00	20	66.67	13.56 0.483
E.coli	0	0.00	8	26.67	9	30.00		0	0.00	1	3.33	1	3.33	
Klebsiella	0	0.00	5	16.67	5	16.67		0	0.00	1	3.33	1	3.33	
Pseudomonas	0	0.00	2	6.67	2	6.67		0	0.00	0	0.00	0	0.00	
Staphylococci	0	0.00	6	20.00	5	16.67		0	0.00	4	13.33	4	13.33	
Enterobacter	0	0.00	2	6.67	3	10.00		0	0.00	0	0.00	0	0.00	
Candida	0	0.00	1	3.33	2	6.67		0	0.00	0	0.00	0	0.00	
E.coli & Klebsiella	0	0.00	0	0.00	0	0.00		0	0.00	1	3.33	1	3.33	
E.coli & Serratia	0	0.00	0	0.00	0	0.00		0	0.00	0	0.00	1	3.33	
E.coli & Enterobacter	0	0.00	0	0.00	0	0.00		0	0.00	1	3.33	1	3.33	
Staphylococci & Serratia	0	0.00	0	0.00	0	0.00		0	0.00	1	3.33	1	3.33	

* Significant at level P < 0.05 .

Table (9) Correlation between catheter associated urinary tract infection assessment profile (CAP), local UTI manifestations and systemic manifestations levels of the studied patients among the studied groups throughout periods of study.

	The studied patients (n=60)											
	CAP level											
	Control group (n=30)						Study group (n=30)					
	Pre care		After a week		After 2 weeks		Pre care		After a week		After 2 weeks	
r	P	r	P	r	P	r	P	r	P	r	P	
▪ Local UTI manifestations	0.379	0.039*	0.200	0.289	0.234	0.213	-	-	0.542	0.002**	0.444	0.014*
▪ systemic manifestations	-0.089	0.640	0.453	0.012*	0.582**	0.001**	-	-	0.355	0.054	0.352	0.056

r: Pearson 'correlation coefficient * Significant at level P < 0.05. * Highly significant at level P <0.01.

Table (10) Correlation between catheter associated urinary tract infection assessment profile (CAP) and socio-demographic characteristics of the studied patients among the studied groups throughout periods of study.

Characteristics	The studied patients (n=60)											
	CAP level											
	Control group (n=30)						Study group (n=30)					
	Pre care		After a week		After 2 weeks		Pre care		After a week		After 2 weeks	
r	P	r	P	R	P	r	P	r	P	r	P	
Age	0.020	0.918	0.294	0.115	-0.149	0.433	-	-	0.272	0.145	0.246	0.191
Gender	0.438	0.016*	-0.257	0.170	0.223	0.236	-	-	0.004	0.983	-0.074	0.698
Educational level	0.080	0.674	0.043	0.820	-0.035	0.854	-	-	-0.151	0.425	0.115	0.544
Residence	-0.104	0.586	0.000	1.000	-0.220	0.243	-	-	0.214	0.256	0.205	0.277
BMI	0.034	0.859	0.184	0.331	-0.235	0.212	-	-	-0.281	0.132	-0.134	0.479
Duration of previous admission (in days)	-0.119	0.532	0.395	0.031*	0.066	0.729	-	-	-0.183	0.334	-0.030	0.873
Prognosis	0.006	0.974	0.351	0.057	0.005	0.977	-	-	-0.140	0.460	-0.123	0.518

r: Pearson 'correlation coefficient * Significant at level P < 0.05. * Highly significant at level P <0.01.

Discussion

Healthcare-associated infections (HAIs) are the type of infections where patients acquired during the course of receiving treatment for other conditions within a healthcare in Intensive Care setting and are not present or incubating at the time of admission. Critically ill patients in Intensive Care Units (ICUs) are at high risk for this type of infection as a result of underlying immunodeficiency, comorbidity, and placement of invasive devices and indwelling urinary catheters are one of the most frequently used invasive medical devices⁽³³⁾, Catheter-associated urinary tract infections (CAUTIs) are a major threat to public health since they are the most common hospital-acquired infections worldwide, accounting for 40% of them, and leading to Healthcare professionals have proposed several strategies for preventing HAIs including compliance with hand hygiene, aseptic technique, and contact isolation precautions for patients, but these strategies can be difficult to maintain⁽³⁴⁾

Chlorhexidine gluconate (CHG) is a widely used as antiseptic agent that has excellent antimicrobial activity and rapidity of action. Furthermore, in contrast with other antiseptic agents, the residual antimicrobial activity of CHG is not affected by the

presence of body fluids and blood⁽³⁵⁾. The main objective of this study was to evaluate the efficacy of protocol of hygienic care by chlorhexidine gluconate on the occurrence of a catheter associated urinary tract infection among critical ill patients.

Concerning socio-demographic characteristics of the studied patients.

The present study showed that more than one third of the patients in both control and study groups were in between (40-<50) years old, It may be contributed to as age is a non-modifiable risk factor that impacts immunity and infection risk in the setting of exposure to a potential pathogen, Physical and functional incapacity, combined with the immunologic changes of aging, including those caused by immunosuppressive medications. This study as the same line of **Cassir et al. (2015)**⁽¹¹⁾ who reported that the mean age of the studied patient were 58 in between (46-68) and 61 in between (48-73) years in the study and control group. Similarly **Noto et al. (2015)**⁽⁹⁾ who reported that the age medians of study groups were 56.0 (42–68) and 56.0 (42–68) years in the study and control group. In the contrary, **Giles, et al. (2019)**⁽²⁴⁾ who concluded that all patients with age >65 years old who were admitted in the emergency department during one-month period developed CAUTI

. **Regarding sex and marital status**, it was found that more than half of the patients in the control and study groups were male and more than one third were married. Our results agree with those of (**Galiczewski, et al. (2017)**)⁽²⁵⁾ reported that more than half of the patients in control and study groups in the sample were male and married. **Regarding educational level** it was found that nearly one quarter of studied patient in control and study groups, were secondary educated. this finding with the same line with **Perotte, et al (2019)**⁽²⁶⁾ reported that about one quarter of studied patient in the control and study groups were secondary educated . **as regard to occupation**, it was observed that less than half of the patients in control and study groups were not working this finding was in the same line with **Mullin K et al (2017)**⁽⁴⁾ who reported that one quarter of the patients had secondary education, and about less than one half were not working. **Concerning to Residence** it was found that there were half of the patient in the studied groups are lives in rural areas and other half lives in urban area. This finding with the same line with **Vernon O, et al (2016)**⁽²⁷⁾.

Regarding medical diagnosis .The results demonstrated that, the majority of the patients in the control group and study group

had hemorrhagic and had ischemic stroke. This finding was in the same line with **Richards et al., (2017)**⁽²⁸⁾ , who reported that Patients in neurological ICUs were diagnosed as hemorrhagic and ischemic stroke. As regard to **body mass index**, our result pointed that more than one third of the patients in both control and study groups were overweight and obese class I. This finding was agreed with **Haifler, M, et.al (2017)**⁽²⁹⁾, who stated that mean of body index in studied group were $26.45 \pm (3.4)$ $27.1 \pm (3.13)$ (about one third of studied patients were obese) and have high risk of UTI. **Regarding to reason of catheterization**, the results revealed that most of the patients in both control and study groups catheterized because of limited mobility, followed by about two third of them catheterized for measuring urinary output. This result was in the same line of **Sampathkumar, et al (2017)**³⁰⁾ who performed study about reducing catheter-associated urinary tract infections in the ICU.

Regarding size of the catheter, most of the patients in the control and study groups were catheterized with 16 Fr catheter size. This may be due to availability of the equipment in ICU and patient characteristics (age, sex and size of urethral caliber). This

finding was the same line of **Ferguson, et al. (2018)**⁽³¹⁾.

As regard catheter associated urinary tract infection assessment profile, the results revealed that about two third of patients in control group were have severe symptoms compared to the minority of patients in study group had severe symptoms. This result was in the same line of **Pietraszak, et al. (2015)**⁽³²⁾ **In relation to total local UTI manifestation** The result was found about two third of patient in the control group compared to less than one third of patient in the study group had **local UTI manifestation** . This finding was in the same line with **Dubbs et, al (2019)**.⁽³³⁾

Regarding to Distribution of the studied patients according to systemic manifestations of catheter associated urinary tract infection. This result demonstrated that the majority of patient in control group had sever systematic manifestation compared to the minatory of patient in the study group. **This finding was in the same line with Rosenthal, et al. (2019)**⁽³⁴⁾. On the other hand, CAUTI was asymptomatic in critically ill patient that reported by **Weiss, et al (2019)**⁽³⁵⁾

Concerning blood chemistry. The present results revealed that mean serum leukocytes count was 14.45 ± 2.39 and 10.82 ± 1.86 in

control and study group after 2 weeks. The mean CRP level was 77.07 ± 6.41 and 37.33 ± 2.64 in the control and study group. This results was supported by another study of **SartoriM et,al (2021)**⁽³⁶⁾

In relation to bacterial count and causative microorganisms of CAUTI, the results of the present study revealed the most of the patient in the control group had positive colony count as compared to few of the patients in the study group were have negative colony count This finding was supported by **Meddings, et al (2015)**⁽³⁷⁾ **In relation to types of microorganisms**, it was showed that E-coli was the commonest pathogen in control group since these organisms are capable of colonizing the intestinal and vaginal tracts as well, these sites can serve as potential reservoirs for UTIs and CAUTIs ,followed by Klebsiella , Staphylococci , Enterobacter and Pseudomonas This finding was in the same line of **Sabir et al.(2017)**⁽³⁸⁾ **Concerning Correlation between catheter associated urinary tract infection assessment profile, local UTI manifestations and systemic manifestations levels** the current study showed that there was positive correlation between CAP level and systemic manifestations after week and 2 weeks in control group. This finding was in the same

line with **Durant, et al (2017)⁽³⁹⁾** . As regard **Correlation between catheter associated urinary tract infection assessment profile and sociodemographic characteristics of the studied patients.** The current results showed that no significant correlation between CAP and sociodemographic characteristics of the studied patients except a significant positive correlation was found related duration of previous admission in control group. this finding with the same line of **Busl, et al. (2021)⁽⁴⁰⁾** who performed study about Catheter-Associated Urinary Tract Infection (CAUTI) in the Neuro-ICU reported that increase period of previous hospitalization ,lead to increased risk of exposure of CAUTI.

Conclusion

Based on the finding of the current study, it can be concluded that: Application of Protocol of Hygienic Care by Chlorhexidine Gluconate on Occurrence of Catheter Associated Urinary Tract Infection among Critical Ill Patients shows a positive result in decreasing Catheter Associated Urinary Tract Infection, as there was a significant improvement in the total mean scores of laboratory studies immediately , after weak and after two weeks of protocol of Hygienic Care by Chlorhexidine Gluconate implementation among study group in

Neurological Intensive Care Unit of both Tanta University Hospital and Neuropsychiatry center at Tanta Main University Hospital setting in relation to the control group with routine of hospital care of hygienic care implementation.

Recommendations

- Provide clear instruction to patients and care giver on proper hygienic care, urinary catheter care and drainage system by using Chlorhexidine Gluconate.
- Protocol of Hygienic Care by Chlorhexidine Gluconate on Occurrence of Catheter Associated Urinary Tract Infection which included using of aseptic techniques for catheterization and catheter care should be carried out as a routine care for critically catheterized patients.
- Daily evaluation of the need for continuing an indwelling catheter and removal of the catheter whenever possible and use of alternative method of bladder drainage
- Development of in-service training program for all health team workers especially nursing staff in Intensive Care Units about care of indwelling catheterized patients and the preventive measures of catheter-associated urinary tract infections (CAUTIs)-Increase awareness of critical

nurses about daily hygienic care by using Chlorhexidine Gluconate.

-Assessment of problems facing critical care nurse regarding hygienic and catheter care and their effect on nurses' performance and satisfaction. -keeping Chlorhexidine Gluconate material available for all patients and nurses.

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