

ORIGINAL ARTICLE

Effectiveness of Clinical Practice Guidelines on Prevention of Catheter-associated Urinary Tract Infections in Selected Hospitals*Sherine Peter¹, Elsa Sanatombi Devi^{*}, Shalini G Nayak¹*¹*Manipal College of Nursing, Manipal Academy of Higher Education, Manipal-576104 (Karnataka) India***Abstract**

Background: Urinary Tract Infection (UTI) accounts for forty to fifty percentage of hospital acquired infections. Catheter Associated Urinary Tract Infections (CAUTI) are the majority of health care associated infections. The urinary catheter leads to bacterial colonization, recurrent and chronic infections, bladder stones, septicemia, damage to the kidneys, bladder and urethra and development of antibiotic resistance. CAUTI mainly occurs due to the non sterile techniques followed by the nurses during the insertion and maintenance of indwelling catheter. **Aim and Objectives:** To assess the insertion practice of indwelling catheter and assess the maintenance practice of indwelling catheter as measured by structured observation check list and evaluate the effectiveness of clinical practice guidelines. **Material and Methods:** This was a quasi experimental non- equivalent control group pre test and post test design used over a period of one year. Demographic data were collected from nurses and patients. The insertion and maintenance practice of indwelling catheter data were gathered by using observational check list and urine culture and sensitivity analysis. Seven days interval was kept between pre test and post test after the implementation of clinical practice guidelines. Institutional Ethics Committee clearance was obtained and CTRI registration was done. **Results:** Data were collected from 70 participants (experimental – 35 and control – 35). The results of the study showed that the implementation of clinical practice guidelines in indwelling catheter insertion and maintenance was effective as the p value was 0.001. The urine culture and analysis reported that, there were three cases which showed the growth of micro organisms in the

experimental group, where as in control group two at the time of pre test. After implementing the clinical practice guidelines on CAUTI, the growth of organisms was not reported. **Conclusion:** Clinical practice guidelines strongly recommend that reporting and monitoring for infection control practices is a critical component of CAUTI prevention. It also emphasized the education and training of nurses regarding infection control measures and periodic assessment of the practice among them has also been shown to reduce the incidence of CAUTI. Thus the study creates an opportunity to develop and implement clinical practice guidelines and it helps to improve nurses practice in infection control and reduce the incidence of CAUTI in the hospitals.

Keywords: Urinary Tract Infections, Catheter Related Urinary Tract Infections, Clinical Practice Guideline

Introduction:

Catheter Associated Urinary Tract Infection (CAUTI) is a hospital acquired infection which can lead to extended hospitalization and increased mortality [1]. Indwelling catheter *in situ* increases the risk of infection three to seven percentage. Nurses driven protocol is helpful in the prevention of catheter associated urinary tract infection [2]. CAUTI prevention is challenge in the health care quality. Implementing best practice and educating health care personnel will serve as the pillar stone for prevention of CAUTI [3].

CAUTI lead to unnecessary antimicrobial use, long-lasting hospitalization and increased health care expenses. To reduce CAUTI occurrence,

focus should be on evidence-based use of IUCs throughout the insertion and maintenance practice. Evidence based guidelines help to prevent CAUTI. Guidelines derived from research and other sources of evidence were able to effectively contribute towards patient outcome [4]. Evidence related to the nursing interventions was identified by searching electronic databases MEDLINE, CINAHL and Cochrane library, and Google Scholar [5].

To improve the patient safety and prevent CAUTI, the health care providers should maintain best practices which includes sterile catheter insertion, maintenance of closed drainage system, prevention of back flow, following aseptic technique for collecting urine for culture and sensitivity and shorter the duration of catheter placement [6].

Vital elements of CAUTI avoidance include staff education, ongoing monitoring of CAUTI incidence, monitoring catheter insertion and catheter care and ensure timely removal of catheter [7]. Tertiary care private hospital in India found that CAUTI contribute 30-40% of all the nosocomial infections and increased the institutional death rates. Training of the staff with infection control measures were found to be effective in reducing the CAUTIs in hospitals [8]. Enhancing most excellent nursing practices offer quality care and it will prevent CAUTIs rate. So it is vital for the health care providers to build up a CAUTI preventive guidelines in hospitals [9]. The study objective was to assess the insertion and maintenance practices of indwelling catheter measured by structured observation check list and evaluate the effectiveness of clinical practice guidelines by urine culture and sensitivity test. Major outcome considered are reduce the incidence of CAUTI and reduce patient morbidity caused by indwelling catheter infection and improved quality of care.

Material and Methods:

Record analysis revealed that there is 8-10% of CAUTI is reported in the selected hospitals and an evaluative approach was used to conduct the study in medical and urological wards by using quasi experimental non- equivalent control group pre and post test design. There are 53 nurses working in the medical and urological wards and 40-50 urinary catheterizations done per month in both hospitals.

Patients who got indwelling catheter insertion done after admission and nurses who were taking care of them in medical and urological ward were included in the study. Nurses who were not available at the time of data collection and patients with diabetes mellitus, septicemia and indwelling catheter at the time of admission were excluded from the study.

Non probability method, purposive sampling technique was used to select the participants. Data were collected from 70 participants.

Sample size was calculated based on the pilot study findings. The following formula was used for sample size calculation for evaluative research approach.

Comparison of means (independent samples)

$$n = \frac{2s^2(Z_{1-\alpha/2} + Z_{1-\beta})^2}{d^2}$$

$$s^2 = \frac{s_1^2 + s_2^2}{2}$$

s_1 = standard deviation of the first sample

s_2 = standard deviation of the second sample

$$d = \mu_1 - \mu_2$$

= observed difference between the mean values of the two samples

From pilot study

Standard deviation in group I	4.3
Standard deviation in group II	3.1
Mean difference	2.5
Effect size	0.675676
Alpha error (%)	5
Power (1- beta) %	80
1 or 2 sided	2
Required sample size per group	35

Sample size of 70 was found to be adequate.

Validated and pre tested reliable tool was used for collecting the data. Written Informed consent was obtained from all the participants after giving participant information sheet. Demographic data were collected from nurses and patients. In the insertion and maintenance practice of indwelling catheter data were gathered by using observational check list and urine culture and sensitivity analysis. Seven days interval was kept between pre test and post test after the implementation of clinical practice guidelines.

The clinical practice guideline has been prepared after extensive review through Category 1A- Systematic review, Category 1B- Randomized Control Trial and Category 1C- Evaluating other clinical practice guidelines (CDC and European and Asian guidelines) followed in different settings. Interventions and practices considered for the development of guidelines include standard precautions at the time of insertion and maintenance of indwelling catheter and education to nurses. The study was approved by Institutional Research Committee; Institutional Ethics Committee and CTRI registration was obtained

(CTRI/2017/04/008418). Data collected were analyzed by using software SPSS16.0.

Results:

The age group of nurses ranged between 31-35 years for 15 (42.89%) in the experimental group whereas the control group it was 12 (34.29%). Majority 32 (91.42%) of the nurses in the experimental group were females and in the control group it was 30 (85.71%). In relation to education 15 (42.86%) in the experimental group had GNM qualification and in the control group it was 17 (48.57%). The information source from infection control department for experimental group was 17 (42.89%) where as the control group it was 16 (45.71%). In experimental group two (5.71%) and in control group four (11.43%) participants had exposure to CNE on CAUTI is summarized in Table 1.

The patient population majority of them were females 32 (91.42%) and 30 (85.71%) in the experimental and control groups respectively during pre test and post test. Duration of hospitalization <2 days at the time of pre-test in the experimental group was 19 (54.29%) and in post test 2-4 days was 20 (57.14%). During pre test the control group 2-4 days hospitalization was 22 (62.86%) and in post test < 2 days was 20 (57.14%). At the time of pre-test and post test the current use of antibiotics in experimental group was four (11.43%) where as in control group three (8.57%) is listed in Table 2.

The nurses in experimental group, practice scores on preventive practices of CAUTI insertion, only 10 (28.57%) had good practice in pre test and very good practice observed as 18(51.43%) in post test; where as in control group 11 (31.43%) had good practice during pre test and post test. The description of practice scores on preventive

practices of CAUTI in insertion during pre test and post test is depicted in Fig 1. The practice scores on maintenance of indwelling catheter in the experimental group during pre test observed as 12 (34.29%) had good practice and 10 (28.57%) participants had very good practices in post test; where as in control group 12 (34.29%) had good practice during pre test and post test. The practice scores on preventive practices of CAUTI in maintenance during pre-test and post-test is showed in Fig 2.

Since the practice score on insertion and maintenance was average, poor and very poor among six nurses following measures were taken to reinforce their practice which included displaying CPG in the medical and urology wards, structured teaching programme along with demonstration and assessment of practice using structured observation checklist.

Reinforcement practice post test score of six nurses in the experimental group revealed that one

(16.66%) had average practice and five (83.33%) had good practice on preventive practices of CAUTI in indwelling catheter insertion which is depicted in Fig 3. All (100%) of them had demonstrated good practice on preventive practices of CAUTI in indwelling catheter maintenance which is presented in Fig 4. Clinical practice guideline was effective in the insertion and maintenance practice of indwelling catheter because the p value was 0.001. Effectiveness of clinical practice guidelines on insertion practice of indwelling catheter is summarized in Table 3. Effectiveness of clinical practice guidelines on maintenance practice of indwelling catheter is detailed in Table 4.

Clinical practice guidelines were clinically effective and 100% prevention of CAUTI in the clinical setting. Urine culture shows the growth micro organisms which include *E. coli*, *Klebsiella*, *Candida* species, *Pseudomonas* species and *Staphylococcus aureus*.

Table 1: Frequency and Percentage Distribution of Nurses based on Sample Characteristics

Participant characteristics	Experimental (n=35)		Control (n=35)	
	f	%	f	%
Age in years				
21- 25	4	11.43	2	5.71
26-30	10	28.57	12	34.29
31-35	15	42.89	10	28.57
36-40	6	17.14	11	31.43
Gender				
Male	3	8.57	5	14.29
Female	32	91.42	30	85.71

Continued...

Participant characteristics	Experimental (n=35)		Control (n=35)	
	f	%	f	%
Education				
G.N.M	15	42.89	17	48.57
B.Sc. Nursing	11	31.43	8	22.86
Post Basic B.Sc. Nursing	8	22.86	7	20
M.Sc. Nursing	1	2.86	3	8.57
Professional Experience				
<2	1	2.86	2	5.71
2-4	6	17.14	5	14.29
5-7	9	25.71	11	31.43
Source of Information				
Hospital policies	12	34.29	11	31.43
Infection control Department	15	42.89	16	45.71
Text books	5	14.29	4	11.43
Health article	0	0	1	2.86
Journal	3	8.57	3	8.57
Attended CNE on CAUTI				
Yes	2	5.71	4	11.43
No	33	94.29	31	88.57
Area of Work Experience				
Medical ward, Post operative	4	11.43	6	17.14
Paediatric ward, OBGY	5	14.29	2	5.71
Emergency, Surgical, OBGY	3	8.57	2	5.71
ICU, Medical, Surgical	2	5.71	4	11.43
Urological, Post operative	3	8.57	1	2.86
Post operative, Surgical	8	22.86	2	5.71
Paediatric, OBGY	5	14.29	10	28.57
Emergency, Medical, Surgical	3	8.57	3	8.57
Emergency, Paediatric	2	5.71	5	14.29

Table 2: Frequency and Percentage Distribution of Patients based on Sample Characteristics

Participant characteristics	Experimental (n=35)				Control (n=35)			
	Pre test		Post test		Pre test		Post test	
	f	%	f	%	f	%	f	%
Gender								
Male	3	8.57	3	8.57	5	14.29	5	14.29
Female	32	91.42	32	91.42	30	85.71	30	85.71
Duration of Hospitalization								
<2days	10	28.57	11	31.43	12	34.29	20	57.14
2-4days	19	54.29	22	62.86	20	57.14	8	22.86
>4day	6	17.14	2	5.71	3	8.57	7	20
Current use of antibiotics								
Yes	4	11.43	4	11.43	3	8.57	3	8.57
No	31	88.57	31	88.57	32	91.42	32	91.42

Table 3: Effectiveness of Clinical Practice Guidelines on Insertion Practice of Indwelling Catheter among Experimental and Control Group (N=70)

Group	Practice score on insertion		Mean difference	Standard error	df	t value	p value
	Mean	Standard Deviation					
Experimental	53.40	7.63	8.22	1.664	68	4.945	0.001*
Control	45.17	6.21					

* $p < 0.05$ (significant)

Table 4: Effectiveness of Clinical Practice Guidelines on Maintenance Practice of Indwelling Catheter among Experimental and Control Group (N=70)

Group	Practice score on insertion		Mean difference	Standard error	df	t value	p value
	Mean	Standard Deviation					
Experimental	40.00	6.20	7.257	1.381	68	5.254	0.001*
Control	32.74	5.31					

*p<0.05 (significant)

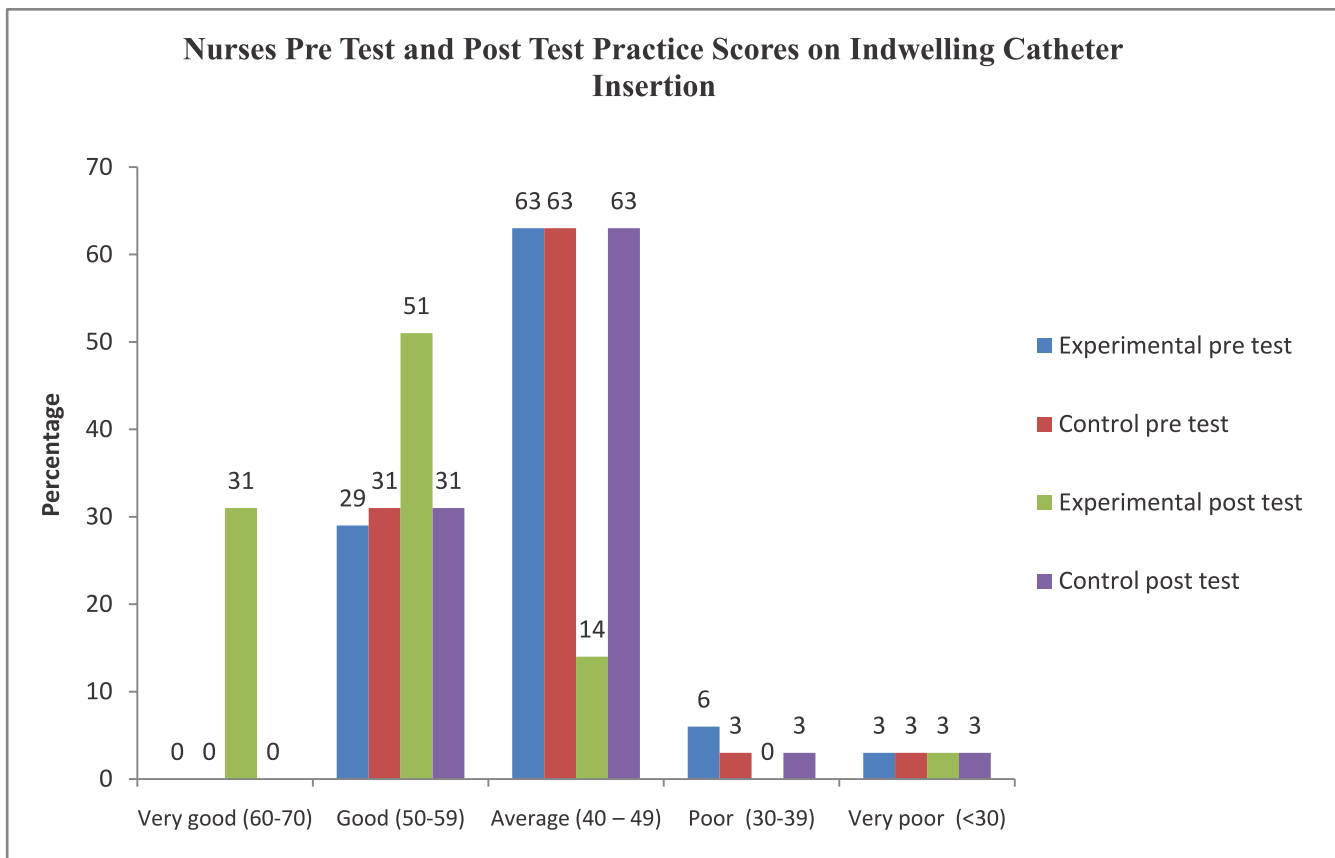


Fig. 1: Bar diagram showing the Percentage Distribution of Pre Test and Post Test Practice Scores on Nurses during Indwelling Catheter Insertion

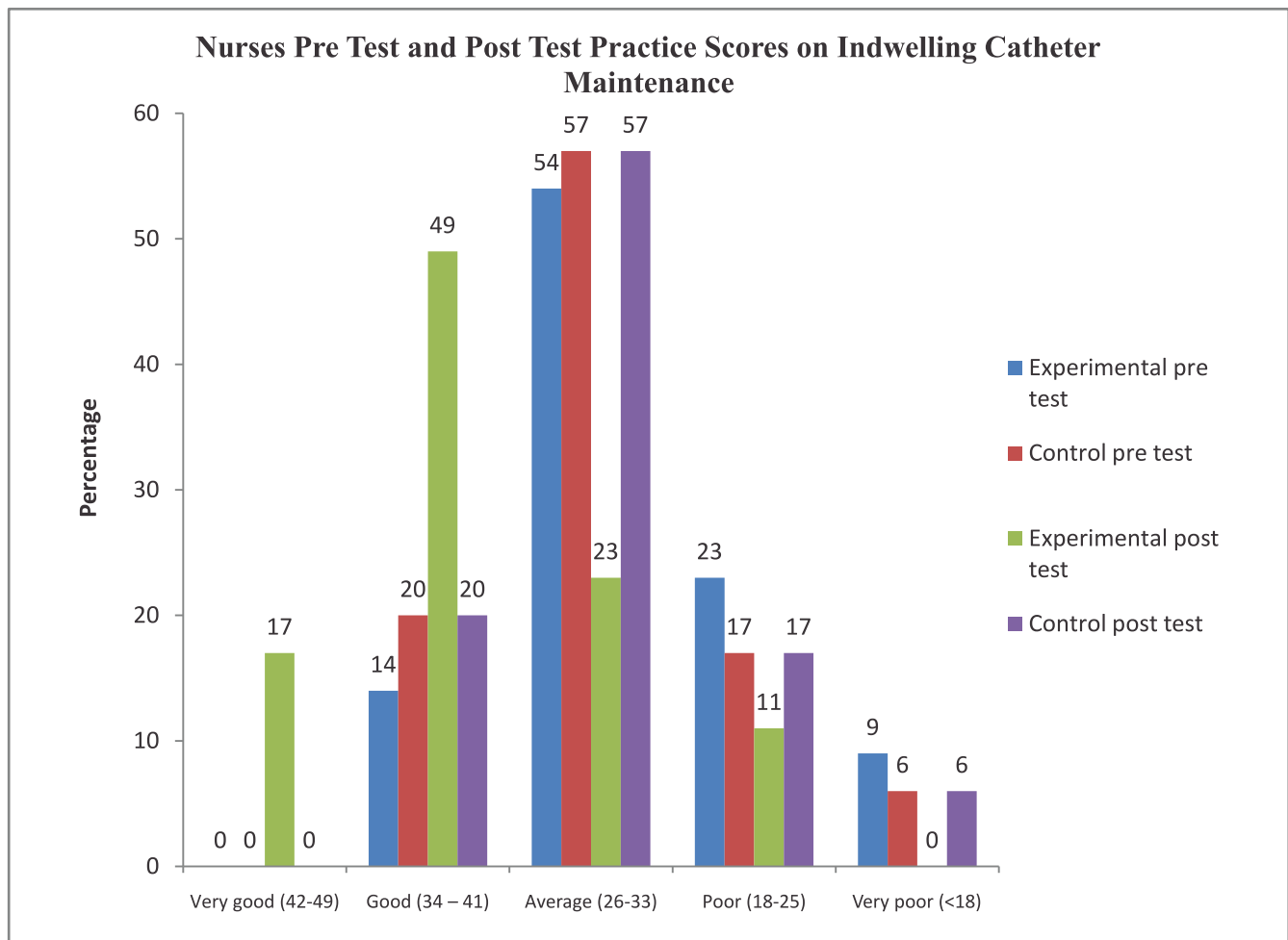


Fig. 2: Bar diagram showing the Percentage Distribution of Pre Test and Post Test Practice Scores on Nurses during Indwelling Catheter Maintenance

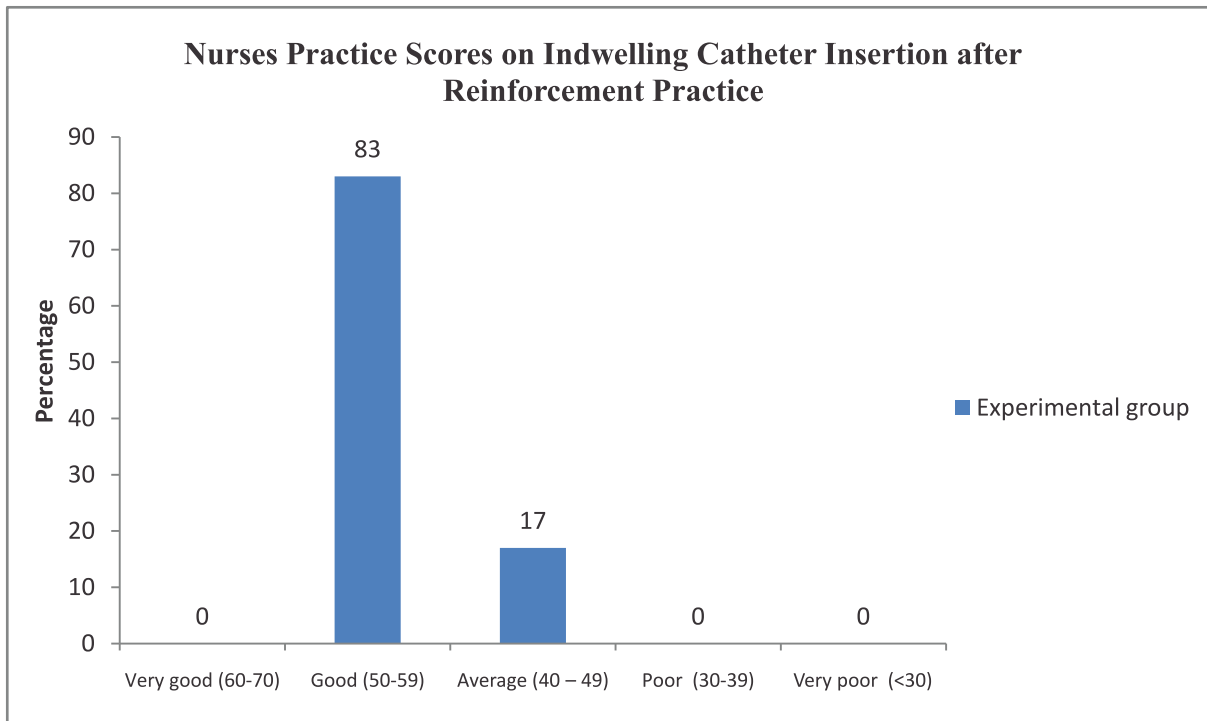


Fig.3: Bar Diagram Showing the Percentage Distribution of Reinforcement Practice Scores on Indwelling Catheter Insertion

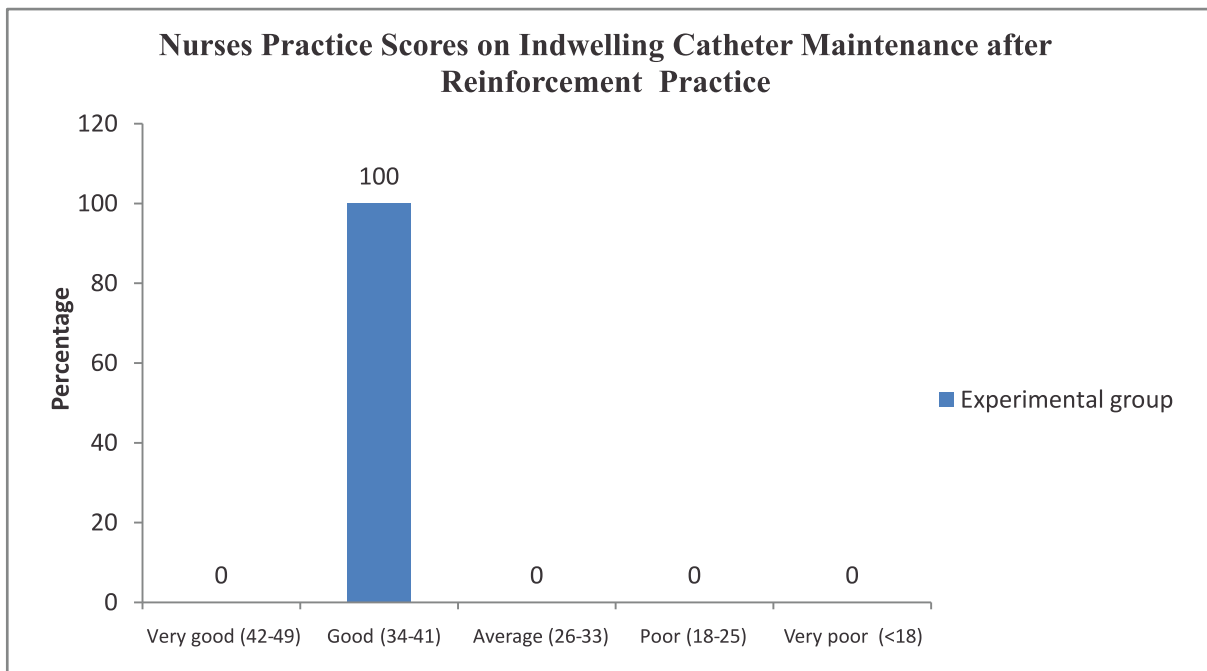


Fig.4: Bar Diagram Showing the Percentage Distribution of Reinforcement Practice Scores on Indwelling Catheter Maintenance

Discussion:

This study aimed at describing the effectiveness of clinical practice guidelines to prevent the CAUTI by using evaluative approach. The present study showed that the implementation and practice of clinical practice guidelines in indwelling catheter insertion and maintenance was effective to prevent CAUTI.

It was found that, after implementation of clinical practice guidelines the infection was reduced and the reported case was one. Reinforcement was given to the nurses and no growth of organisms was reported. There was a significant difference in the mean pre-test and post-test practice scores in the insertion and maintenance of indwelling catheter as the p value was 0.001. This is in concordance with studies done before; in that analysis of CAUTI rates were conducted by using a chi square test. Pre intervention CAUTI rates were 10.40 and post intervention CAUTI rates. These differences were statistically significant ($\chi^2 = 55.00$, $df = 1$) and showed that educating nurses on the CDC recommended EBP guidelines significantly decreased CAUTI rates [10]. It is also in accordance with the findings reported in a study which showed the mean CAUTI incidence rate for the pre intervention period was 90.12/1,000 catheter days and for the post intervention phase 65.69/1,000 catheter days [9].

Urine culture shows the growth of *E. coli*, *Klebsiella*, *Candida* species, *Pseudomonas* species and *Staphylococcus aureus* and there was a significant difference in the mean pre-test and post-test practice scores after the implementation of CPG in the insertion and maintenance of indwelling catheter as the p value was 0.001. This is in congruence with findings reported before *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*,

and *Escherichia coli* were detected. It was found that, statistically significant reduction in the CAUTI rate in the ICU from 7.6 to 5.0 ($P < 0.001$) and in the step-down units from 15.3 to 12.9 per 1,000 catheter days ($p = 0.014$) [11].

It has been seen in this study the CAUTI was reduced and the reported case was one. The p value was 1.00. Results were statistically not significant but clinically significant and there was 100% reduction in the CAUTI incidence when comparing the pre intervention period. This is in accordance with a study conducted by using the Wilcoxin signed rank test and compare the CAUTI rates between the pre and post intervention time periods. a- level of $p < 0.05$ was used. Results were not statistically significant ($p = 0.285$) but clinically significant and there was a 50% reduction in CAUTI incidence when comparing the pre intervention period [12].

Implications of the study:

The findings of the study have implications on Nursing practice, Nursing education, Nursing administration and Nursing Research.

Nursing practice:

Knowledge on evidence based guidelines to prevent CAUTI among patients with indwelling catheter at the time of insertion and maintenance, in the clinical area will helps to keep the patients safe from cross infection. The findings of the study help for the implementation and monitoring of infection prevention and control standards and enhance the quality of life of patients with indwelling catheter.

Nursing education:

Nursing education prepare the nurses to function as educators because Nurses not only function as

staff nurse in the hospitals but also as nurses educators and infection control nurses as a part of hospital infection control committee. The proper education on infection control practices helps to decrease the rate of mortality, morbidity among the patients admitted with indwelling catheter. Curriculum should include the increasing the awareness of Indwelling Urinary Catheters (IUCs) insertion and maintenance in hospitalized patients, addressed practical, primarily nurse-controlled inpatient risk-reduction interventions, and reduce the use of the IUC.

Nursing administration:

The administrators should plan and organize educational program for nursing personnel, in order to prepare them to provide quality care. Nurse administrators have to plan Continuing Nursing Education (CNE) programs to keep abreast the knowledge of indwelling catheter insertion and maintenance in order to prevent CAUTI and to provide quality care to the patients. Administrators should ensure the frequent evaluation of such programs and also support, drive, sustain and demonstrate EBP in CAUTI prevention care and to provide re-enforcement and motivation for performing infection control practices.

Nursing research:

Research in nursing field helps in the growth of the professional and personnel life. Research studies can be emphasized on preventive practice on CAUTI in the field of nursing and paying attention towards the achievement of good health status and reduced risk of infections with indwelling catheter. The Nurse researchers can also develop EBP guidelines for the effectiveness of infection control practices.

Conclusion:

The Center for Disease Control and Prevention and European and Asian guidelines strongly recommend that, reporting and monitoring of infection control practices is a vital part in CAUTI prevention. It also emphasizes about education and training of nurses concerning infection control measures and periodic reassessment of the practice among them reduce the incidence of CAUTI. The present study showed that clinical practice guidelines regarding CAUTI were effective in participants to improve their practice of infection control and reduce the occurrence of CAUTI in the hospitals.

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