Indwelling Urinary Catheter Management: Effect of an Interactive Workshop on Nurses' practice and Perception

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Abstract: Background: Over the past several years, catheter management has been evaluated to the best practice technique for providing effective catheter care and minimizing the catheter-associated infections and complications. **Aim:** Evaluate the effect of an interactive workshop on nurses' practice and perception for managing indwelling urinary catheter **Design:** A quasi- experimental. **Setting:** The study was conducted at the National Training Institute affiliated to the Ministry of Health. **Subject:** A convenience sample consisted of 40 female nurses selected from different specialties. **Tools of data collection:** three tools were used: **1-Nurses'self- administered questionnaire**: It was used pre/post tests and one month after the workshop and consisted of 2 parts: -demographic data - nurses' knowledge assessment sheet. **2-Nurses 'observational checklist**: to evaluate level of nurse's practice (pre/post workshop & after one month) **3- Nurses' perception assessment sheet**: It was used pre/posttests to assess nurses' perception regarding expected urinary catheter complications, ability to solve those problems through proper decision making. **Results:** The mean age of the studied nurses was 30.0±8.5. The majority of nurses (80.0%) had satisfactory level of knowledge post the workshop. Also, 92.5% of the nurses had satisfactory level of practice post the workshop. The nurses' percentage of satisfactory level of perception about expected urinary catheter complications, problem solving and potential solution was increased post workshop. As well, nurses' attitude toward urinary catheter management was improved post workshop. **Conclusion:** There was a highly significant difference between nurses' knowledge and practice pre/post and one month later after implementing the interactive workshop. As well, nurses' perception regarding expected urinary catheter complications and ability of them to solve problem through correct potential solution in each situation were significantly increased post workshop. Furthermore, a positive improvement was noticed as regards their attitude towards urinary catheter practices post workshop. **Recommendations:** Implement this developed interactive workshop on other groups of nurses in order to improve their knowledge, practice and perception of managing indwelling urinary catheters. Consider results of this study as a valuable baseline for further researches for evidence of results and generalization.
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1. Introduction:

Indwelling urinary catheter is a flexible plastic tube (catheter) inserted into the bladder that remains (dwells) there to provide continuous urinary drainage. The principal type of the indwelling catheter is the "Foley" which has a balloon on the bladder end. After the Foley catheter is inserted in the bladder, the balloon is inflated with air or fluid so that the catheter cannot pull out. Removal is accomplished simply by deflating the balloon and slipping the catheter out **(Cafasso, 2012)**.

Urinary catheterization carries a risk of causing urinary tract infection the procedure is performed under aseptic technique by qualified nursing staff. Also as an expected outcome, the urinary catheter must insert into the bladder without problem as well patient and staff safety are maintained **(Urology Nursing Working Group, 2013)**.

Indications for using a catheter include providing relief when there is urine retention, monitoring urine output for critically ill patients and managing urination during surgery. But the urinary tract infection remains one of the most common healthcare-associated infections in the intensive care unit and predominantly occurs in patients with indwelling urinary catheters. Duration of catheterization is the most important risk factor for developing catheter-associated urinary tract infections (CAUTIs).The high impact intervention of urinary catheter care and compliance with best practices set out the key elements of care in prevention of CAUTI **(Herter & Kazer, 2010 and Talaat, et al., 2012)**.

Catheter-associated urinary tract infections are the most frequently infection among hospitalized patients, representing 30-40% of all nosocomial infections. CAUTIs are associated with considerable morbidity, prolonged hospitalization, and greater health care expenditures so identifying risk factors for acquiring CAUTIs is important to suggest methods for preventing them, include duration of catheterization,

older age, female sex and impaired immunity **(Nicolle, 2014)**.

Recommendation on prevention of catheter-associated urinary tract infection provides the principles for best practice of urinary catheter care to healthcare professionals, especially nursing staff. It can serve as a model in formulation of strategies, programmers and plans for prevention of catheter-associated urinary tract infection in individual institutions. The incidence of post-operative urinary retention (POUR) has been reported in the range of 5-75% of all surgical procedures, such as catheterization, which is widely accepted as an important factor to urinary tract infection **(Alsaidi, et al., 2013)**.

Nurses are at the frontline of catheter care and as the providers most involved with IUCs in hospitalized patients, nurses are responsible for urinary catheter placement, day-to-day management, and the removal of IUCs. Also, responsible for specimen collection, nurses play a vital role in the diagnosis of CAUTIs and among catheterized patients, they are often the first to notice a clinical change or technical problem in addition their central role in IUC care and management **(Yoon et al., 2013)**.

Nurses are responsible and accountable for their actions, decisions and practices to uphold the safety, wellbeing, interests and rights of patients as well to ensure that no actions or omissions are detrimental to the condition and safety of the patient during urinary catheter performance. The nurse must take appropriate actions where they have a duty of care, expected knowledge and understanding of the implications and to practice according to current policies, standards and accepted practices and seek clarification if dissatisfied with a clinical decision or inappropriate practices or orders **(Martin, 2012)** and **(Waitaha, 2015)**.

An interactive workshop means to engage the participants actively in learning new information or techniques. The workshop facilitator makes it possible for audience members to participate actively through helping in setting the agenda, have chances to apply new information to their teaching as well, participants can analyze problems or difficulties in order to figure out solutions and often share their experiences and ideas **(Barnett, 2014)**.

Interactive workshops are recommended to be held when having difficult problem to solve, writing a grant proposal involving several stakeholders, intending to gather user feedback on a resource, tool or service as well, when proposing to improve a process or way of working in a team. The dynamic nature of such workshops encourages creative thoughts and can quickly yield ideas and solutions **(Pavelin, Pundir and Cham, 2014)**.

Significance Of the study:

Urinary tract infection (UTI) is one of the most common hospital-acquired infections; 70%–80% of these infections are attributable to an indwelling urethral catheter. Twelve to sixteen percent of adult hospital inpatients will have a urinary catheter at some time during admission. The daily risk of acquisition of bacteriuria varies from 3% to 7% when an indwelling urethral catheter remains in situ. The CAUTI rates reported in 2011 for facilities reporting to the National Healthcare Safety Network (NHSN) were 0.2–4.8 per 1,000 catheter-days for adult inpatient units. It is estimated that 21% of all bloodstream infections (BSIs) identified 48 hours or more after admission were from a urinary source and that 71% of these were device associated. The incidence was 1.4 urinary BSIs per 10,000 patient-days. All-cause 30-day mortality in these patients was 15% **(Lo, 2014** and **Yokoe, 2014)**.

Catheter associated urinary tract infections still remain a major reservoir of antibiotic resistant pathogens with attendant increase in morbidity and mortality especially in critical care setting. It causes an estimated 13,000 attributable deaths annually and extends length of hospital stay 2 to 4 days as well increasing national health care costs by $400-500M per year. Even though, it estimated to be preventable 40 percent of the time **(Canales et al., 2009** and **Nicolle, 2014)**.

Aim of the study:

The study aims to evaluate the effect of an interactive workshop on nurses' practice and perception of managing indwelling urinary catheter. This aim was achieved through the followings:

- Assessing nurses' knowledge, perception and practice as regards the indwelling urinary catheter management.
- Designing and implementing the interactive workshop.
- Evaluating the effect of the interactive workshop on nurses' knowledge, practices and perception as regards the indwelling urinary catheter management.

Hypotheses of the Study:

- The level of nurses' knowledge and practice about indwelling urinary catheter management will significantly increase after implementing the interactive workshop.
- There will be a positive correlation between nurses' knowledge and practice
- Implementation of the interactive workshop will increase the level of positive perception and attitude of nurses as regards indwelling urinary catheter's management.

Operational definitions:

Nurses' perception: Perception has long been recognized as a concept of importance in nursing, but the meaning of the term has often been ambiguous and

unclear. It is also recognized as the positive or negative beliefs, opinions, experiences or feelings of nurses.

Nurses' perception regarding indwelling urinary catheter management: It means the ability of studied nurses to take correct action, appropriate decisions and exhibit positive attitude during management of urinary catheter through their level of knowledge and thinking.

Research design:

A quasi experimental design was utilized to achieve the aim of the current study.

Setting:

This study was conducted at the National Training Institute affiliated to the Ministry of Health. The site was selected because of the availability of the simulated lab and required manikin.

Subjects:

A convenience sample of 40 female nurses from different specialties (Uro-surgery, ICU, & Neurosurgery) and different health sectors (Al-Hussein, Al-Azhar & Bab Alsharia University Hospitals). They were selected by the National Training Institute.

Tools of data collection:

Three tools were used by the researchers to collect data pertinent of this study.

1- Nurses' self- administered questionnaire: It was designed by the researchers and consists of 2 parts as follows:

A) Demographic characteristics of the studied nurses: It includes, age, qualifications, years of experience and their specialties.

B) Nurses' knowledge assessment sheet (pre/posttests): It was developed by the researchers in the light of relevant and recent literatures. It is consisted of two parts as follows:

a) Indwelling urinary catheter general knowledge: It was adapted from **Altun, & Karakoc, (2010)** and **Urology Nursing Working Group, (2013),** and developed by the researchers to suit the study' aim**.** It was used to assess level of nurses' general knowledge as regards the anatomy and physiology of the urethra, the bladder and abdominal cavity, indications for indwelling catheterization, identifying the three phases of the procedure as well different types of urinary catheters.

b) Indwelling urinary catheter recommendation principles of care: It was adopted from **Seto et al., (2010)**. It was used to assess nurses' level of knowledge as regards recommendation principles of best practice regarding urinary catheter care. It included fourteen items (Education, training and competence assessment, avoid unnecessary urinary catheterization, shorten the duration of indwelling urinary catheterization, proper hand hygiene and using of gloves, aseptic urinary catheter insertion, maintain unobstructed urine flow, maintain a sterile and closed urinary drainage system, individualized catheter change intervals, good meatal care, aseptic urine specimen collection, avoid bladder washout, use of anti-microbial agents, documentation and monitoring and surveillance and quality improvement programs.

The questionnaire sheet consists of 50 multiple choices questions, 15 questions were related to urinary catheter general knowledge and 35 questions were about recommendation principles of best practice regarding urinary catheter care.

Scoring system:

The correct response was scored "1", while the incorrect scored zero. The total satisfactory level of their knowledge was ≥70%; while the unsatisfactory level of knowledge was <70%.

2- Nurses' Observational checklist: It was adapted from **Curran, and Murdoch, (2009)** and **Moola and Konno, (2010)** and used by the researchers to assess nurses' practices regarding urinary catheter technique (insertion, care & removing) and it was utilized as pre/post tests and later after one month as a follow up test. A correct answer was scored as (1), while the incorrect (zero).

Scoring system:

The correct response was scored "1", while the incorrect scored zero. The practice were considered competent if the percent score was (≥80%), and incompetent if it was (< 80%).

3- Nurses' perception assessment sheet: It was utilized as pre and posttest and divided into three parts as follows:

Part one: It was used to assess nurses' perception skills as regards expected urinary catheter complications. It was adopted from **Newman, (2011)** and included these items:

- Urinary tract infection included: fever, bloody and cloudy urine, foul-smelling urine.
- Blockage included: low of urine output and flow, pain, and leakage of urine around the urethral meatus.
- Trauma included: bleeding from the urethral meatus, pain or irritation, and leakage of urine (10items).The evaluation of the mentioned items according "true or false".

Scoring system: a correct perceived item scored as (1), while the incorrect (zero). Satisfactory level was considered from ≥80% while unsatisfactory level less than 80%.

Part two: It was used to assess nurse' ability to solve problem during performing of female' catheter and potential solution (decision making). It was adopted from **Urology Nursing Working group (2013).**It included the followings:

- Removal of the indwelling catheter involved , balloon not fully deflated(one potential solution),
- Cuffing of balloon (three potential solutions).
- Bladder spasms (two potential solutions).
- Cannot remove catheter (two potential solutions).
- Patient anxiety (one potential solution).
- Difficulty with insertion of urinary catheter (three potential solutions).
- Incorrect catheter size (two potential solutions).
- Patient discomfort (two potential solutions).
- Balloon will not inflate (one potential solution).
- Post insertion of catheter involved, no urine return (five potential solutions).
- Catheter bypassing (seven potential solutions).

Scoring system: was a correct solution scored as (1), while the incorrect (zero).Total Satisfactory level was considered from ≥80% while unsatisfactory level less than 80%.

Part three: It was used to assess nurses' attitude as regards urinary catheterization practice. It was adopted from **Jain et al. (2015)** and included, renewal reminder for catheter prevent CAUTI, catheter can be inserted for nursing staff convenience, CAUTI not a very serious illness, education regarding basic catheter care helps prevention CAUTI and maintaining a closed drainage system prevents CAUTI. Evaluated by agree or disagree according to positive response.

Content validity and reliability:

The tools of the study were tested for content validity by a group of experts (5) in the field of Medical-Surgical Nursing. Their opinions were elicited as regards to the tool format layout, consistency, knowledge accuracy, relevance and competence. The reliability of all study tools was tested using Cronbach's test and it range from 0.80 to 0.93. Except for, the best practices recommendations form and nurses' perception (part 2 & 3).

Ethical consideration:

After obtaining the permission from the director of the National Training Institute, the researchers met the studied nurses to explain the purpose of the study and obtain verbal consent for participation. The researchers assured maintaining anonymity and confidentiality of subject's data. Nurses were informed about their rights to refuse participation and to withdraw at any time without any consequences.

Pilot study:

A pilot study commenced once approval had been obtained, a total of 4 nurses (from the different specialties) were recruited in order to test the clarity, feasibility, applicability of the determined tools and estimate the time needed for data collection. By analyzing the pilot study results, no modifications were needed and refinements of the tools were done.

Field work:

- The study was conducted from the first of October 2014 to the end of March 2015.
- The development of the tools and work shop (components & plan) lasted two months.
- The data collection in the pre/post and during the follow-up period (one month later) was done by the researchers.
- The researchers were available during the advertised time schedule of the workshop.
- Maneuver of the study conducted within three phases.
- The interactive workshop was planned to be conducted in three days, (9.00 a.m. - 5.00 p.m.), according to a predesigned agenda.
- The follow up test was planned to be done one month later after the work shop.

- **Program of the first day:** 9.00 a.m.- 5.00 p.m. (Agenda available for all participants):

- **9.00 - 11. a.m.:** The researchers explained the aim of the workshop for all participants and asked them to fill in the self –administered questionnaire sheets and perception assessment sheet by themselves.
- **11. -12.30 a.m.:** using the skills-lab. The studied nurses were divided into 5 groups (8 nurses each). Each nurse was observed using the observational checklist while demonstrating steps of urinary catheter insertion and care on a female doll.
- **12.30 - 1:** morning break.
- **1 -2.30 p.m.**: Continuing the nurses pretest observational checklist regarding urinary catheter removal.
- **2.30-3.0:** break.
- **3.00-5.00 p.m.:** The theoretical part was delivered to the nurses in form of lecture and open discussion that was allowed during the session using data show. Handouts handled for all participants at the end of lecture. The content of the lecture included, anatomy and physiology of the urethra, bladder and abdominal cavity, indications for indwelling catheterization, identify the three levels of procedure as well types of catheters, added to that the fourteen recommendations on prevention of catheter-associated urinary tract infection.

- **Program of the second day: (9.00 a.m.-4.00 p.m.):**

- **9.00.-12 a.m.:-**demonstrations were done by the researchers about catheter insertion, care and removal for the nurses.
- **12.0-12 .30:** morning Break.

- **12.30 -3.30:** p.m. Completed demonstrations about catheter insertion, care and removal for the residual number of nurses.
- **3.30-4.0:** break.
- **4.00-5.00 p.m.:** collected the groups for discussion, any comment or guidance.

- **Program of the third day: (9.00a.m.-4.00 p.m.):**

- **9.00-10.30 a.m.:** The same mentioned tools in the pre-test used as a post test in the theoretical part.
- **10.30-12.30 a.m.:** Re-demonstrations were done by the nurses about insertion, care of female urinary catheter and evaluating them by observational checklist.
- **12.30-1.00 p.m.:** break.
- **1.00- 3.30 p.m.:** Complete re-demonstrations about removal of female urinary catheter and evaluating them by observational checklist were done to compare between acquired nurses practices pre/post workshop.

- **The follow-up period:**

- After one month, evaluating the level of knowledge and practice about urinary catheter technique were done using the same mentioned tools. The researchers tested all participants to answers the same questions (MCQ), and divided the subjects into two equal groups to assess their practice regarding urinary catheter technique (insertion, care& removal). The procedure technique took 10 minutes for each nurse. Comparison between pre/post application of workshop and at the follow-up period was done.

Statistical Analysis:

Data were presented using numbers, percentages, Chi-square and r tests. Level of significance was threshold at 0.05.

3. Results:

As regards the characteristics of the studied nurses, it was revealed that 45% of the nurses their age ranged from 20-<30 years and the mean age was 30.0±8.5. In relation to their qualifications, 75.5% of them have diploma in nursing and it was observed also that 40% were 10+ years of experience. It was declared that 55%, 25% and 20% of the nurses were working at the neurosurgery, uro-surgery and ICU units respectively. A noticeable finding of the study was that all the nurses didn't attend any training regarding urinary catheter training.

Table (1): Illustrates the nurses' total satisfactory level of knowledge related to urinary catheter management pre/post and one month later after the workshop; it was observed that 7.5%, 80% and 62.5% of the studied nurses scored satisfactory level of knowledge in the pre, post and follow up test respectively. A highly statistically significant improvement was observed between the pre/posttests and between the pre/follow up tests ($\mathbf{X^2}$ = 64.9 and 35.0 respectively). While, comparing the post/follow up tests, a significant difference was spotted ($\mathbf{X^2}$ **3** = 11.4).

Table (2): Elucidates the nurses' total competent level of practice as regards urinary catheter technique (insertion, care & removing); it was observed that 12.5%, 92.5% and 67.5% of the studied nurses had competent level of practices in the pre, post and follow up tests respectively. A highly statistically significant improvement was detected between the pre/posttests and between the pre/follow up tests ($\mathbf{X^2}$ = 41.0 and 35.0 respectively). A statistically significant difference was noticed between the pre/follow up tests as $\mathbf{X^2}$ **3** = 20.0

Studying the correlation between total scores of the studied nurses' knowledge and practices, **table (3):** revealed that no correlation was found pre implanting the interactive workshop (r = 152 & p = 0.226). While post and one month later after the workshop implementation, the table revealed a highly significant correlation between the total level of knowledge and practice (r = 0.538, P<0.001** and r = 0.322, P<0.001** respectively).

Table (4-A): Clarifies the nurses' satisfactory level of perception regarding expected urinary catheter complications pre and post the interactive workshop; it was detected that, the nurses' satisfactory perception towards urinary catheter complications had increased in the post test regarding all items. The highly perceived complications were chronic urinary retention and trauma (75.5% each).

Touching the problem solving and potential solutions, **table (4-B):** revealed that, post implementing the interactive workshop, 75.0%, 100%, 75.5%, 100% and 87.5% of the nurses had satisfactory level of perception toward solving the following problems; cuffing balloon off, patient's anxiety, difficulty with insertion and patient's discomfort. As well, the percentage of satisfactory level of problem solving perception increased from 2 to 45%, zero to 37.5%, zero to 45.0%, 2 to 50% and zero to 62.5% in relation to balloon not fully deflated, bladder spasm, cannot remove catheter, catheter bypassing and drainage equipment.

Concerning nurses' positive attitude towards urinary catheterization practice, **table (4-C)**declared that, the percentage of positive response was increased from 5.0%, 10.0%, 12.5% and 75.5% to 100% as regards CAUTI not a very, serious illness, maintaining a closed, drainage system prevents CAUTI renewal reminder for catheter prevent CAUTI, and education regarding basic catheter care helps prevention CAUTI respectively. As well, it was increased also from 20% to 87.5% about catheter can be inserted for nursing staff convenience.

Table (1): Total level of nurses' satisfactory knowledge as regards urinary catheter management and principles of recommendations pre/post and one month later after the interactive workshop(n=40)

Items	Total level of nurses' satisfactory knowledge	
	N0	%
Pre	3	7.5
X^2 **1** = 64.9 ***P***<0.001**		
Post	32	80.0
X^2**2** = 35.0 ***P***<0.001**		
Follow-up	25	62.5
X^2**3** =11..4 ***P***< 0.005*		

X^2**1** = pre/post X^2**2** = pre/follow X^2**3** = post/follow

Table (2): Total level of nurses' competent practice as regards urinary catheter management technique pre/post and one month later after the interactive workshop (n=40)

Items	Total level of nurses' competent practices	
	No	%
Pre	5	12.5
X^2**1** = 41.0 ***P***<0.001**		
Post	37	92.5
X^2**2** = 35.0 ***P***<0.001**		
Follow-up	27	67.5
X^2**3** = 20.0 ***P***<0.05*		

X^2**1** = pre/post X^2**2** = pre/follow X^2**3** = post/follow

Table (3): Correlation between total level of nurses' knowledge and practice pre/post and one month later after the interactive workshop (n=40)

Total Score of Nurses` Knowledge	Total Score of Nurses` Practice	
	r	*P*-value
Pre	0.152	0.226
Post	0.538	0.001**
Follow up	0.322	0.001**

Table (4-A): Nurses' satisfactory level of perception as regards expected urinary catheter complications pre and post the interactive workshop (n=40)

Items		Nurses' satisfactory perception			
		Pre-workshop		Post-workshop	
		no	%	no	%
-	**Chronic urinary retention**	3	7.5	30	75.5
-	**Urinary tract Infection**	5	12.5	27	67.5
-	**Blockage**	0	0.0	25	62.5
-	**Trauma**	5	12.5	30	75.5

Table (4-B): Nurses' satisfactory level of perception regarding problem solving and potential solution of urinary catheter management pre/post the interactive workshop (n=40)

Items		Nurses' satisfactory perception			
		Pre-workshop		Post-workshop	
		No	%	No	%
-	**Balloon not fully deflated**	2	5.0	18	45.0
-	**Cuffing of balloon**	3	7.5	30	75.0
-	**Bladder spasms**	0	0	15	37.5
-	**Cannot remove catheter**	0	0	18	45.0
-	**Patient anxiety**	20	50.0	40	100
-	**Difficulty with insertion**	9	22.5	30	75.5
-	**Incorrect catheter size**	10	25.0	25	62.5
-	**Patient discomfort**	25	62.5	40	100
-	**Balloon will not inflate**	7	17.5	25	62.5
-	**No urine return**	2	5.0	35	87.5
-	**Catheter bypassing**	2	5.0	20	50.0
-	**Drainage equipment.**	0	0.0	25	62.5

Table (4-C): Nurses' positive attitude as regards urinary catheterization practice pre/post workshop (n=40)

Items	Positive nurses' response			
	Pre-workshop		Post-workshop	
	no	%	no	%
- Renewal reminder for catheter prevents CAUTI	5	12.5	40	100
- Catheter can be inserted for nursing staff convenience	8	20.0	35	87.5
- CAUTI not a very serious illness	2	5.0	40	100
- Education regarding basic catheter care helps in preventing CAUTI	30	75.0	40	100
- Maintaining a closed drainage system prevents CAUTI	4	10.0	40	100

4. Discussion:

The presence of an indwelling urinary catheter (IUC) is the principal risk factor for catheter-associated urinary tract infection (CAUTI) development. Despite the risk of prolonged catheter placement, few hospitals actively track catheterized patients, and providers are often not aware of the presence of catheters in their patients. Nurses are at the frontline of catheter care. As the providers most involved with IUCs in hospitalized patients, nurses are responsible for IUC placement, day-to-day catheter management, and the removal of IUCs. Among catheterized patients, they are often the first to notice a clinical change or technical problem **Brusch and Bronze (2013)** and **(Yoon et al., 2013)**. The current study aimed to evaluate the effect of an interactive workshop on nurses' practice and perception for indwelling urinary catheter management.

In the present study, as regards the nurses' characteristics, nearly half of the studied nurses their ages are less than 30 years and the mean of their years of experience was more than eight. In this respect **Madeo and Roodhouse, (2009)** clarified that nurses who are qualified for at least 4 years, would be expected to have at least a basic understanding of best practice for the management of an indwelling urinary catheter.

In the same line, the current study declared that three quarters of the nurses had diploma degree and none of the nurses attended any training regarding urinary catheters management. This result reflects the urgent need of training regarding urinary catheter management; also the years of experience of the nurses helped them to interact with the trainers during the workshop implementation. This result was consistent with **Nazarko, (2009)** who reported that, training should be designed to keep the health care personnel up to date with the new concepts, acquire more knowledge and practices.

Considering nurses' total satisfactory level of knowledge related to urinary catheter management, results of this study showed that, there were highly statistically significant differences between level of acquired nurses' knowledge pre/post and one month later after the interactive workshop. This finding reflects the positive effect of the workshop on nurses' knowledge and their participation through the interactive lecture approach, improved urinary catheter management. This result was congruent with that of **Drekonja et al. (2009)** who stated that, a more effective form of teaching with explanation of the underlying concepts is required to improve knowledge and application of best practice technique for the management of an indwelling urinary catheter, as indicated by the significant improvement in post workshop test scores.

As regards the nurses' total competent level of practices related to urinary catheter management, results of this study revealed that, there were highly statistically significant differences between level of acquired nurses' practices pre/post and one month later after the interactive workshop related to urinary catheter insertion, care and removal. This finding indicates that the role of trainers in lab-skills was a right way, according to definite observational checklist, to get the best practices of urinary catheter technique. In this context, **Harrods et al. (2013)** stated that, retaining and utilizing what was learned in practice will help in performing best practices about maintaining a sterile continuously closed drainage system, keep catheter properly secured to prevent movement and urethral traction also, maintaining unobstructed urine flow.

In the same line, **Willson et al. (2009)** and **Altun and Karakoc (2010):** had another point of view which is while scores of his nurses improved following the intervention, there is of course a huge difference between remembering something heard in a teaching session and actual knowing, retaining and utilizing what was learned in practice. A sustained program of initial education, observed practice and planned updating is necessary.

The finding of this study revealed that, pre-program, no correlation was found between total level of knowledge and practice, while immediately post and one month later after the workshop implementation, the study declared a highly significant correlation between total level of

knowledge and practice. Several recent studies by **Fink et al. (2012)** and **Yoon, et al. (2013)** emphasized that education and training of nursing staff, should play an important role based on practitioners' effort to ensure best patient outcomes and reduce the likelihood of complications. Practitioners should train caregivers' especially nursing staff on the correct technique for catheter insertion and removal focusing on the importance of catheter hygiene and the avoidance of catheter-related problems advising them on common problems occurring with urinary catheters.

The present study denoted that, post implementing the workshop, the studied nurses' showed improved level of perception regarding expected complications of urinary catheterization in relation to chronic urinary retention, urinary tract infection, blockage and trauma. This result may be explained as, equipping the nurses with relevant knowledge and practices will increase their understanding of the possible urinary catheter complications which help in preventing them. This finding was supported by **Harrod et al. (2013)** who stated that positive changes in nurses' perception might decrease urinary catheter-related complications.

Concerning nurses' perception in relation to problem solving and potential solutions of urinary catheter management, it was declared that, post implementing the workshop, there was an improvement in the satisfactory level of perception regarding nurses ability to solve urinary catheter-related problems. The highly percentage gained post workshop as regards all items especially balloon not fully deflated, cuffing off balloon, cannot remove catheter, patient anxiety, difficulty with insertion of urinary catheter, incorrect catheter size, patient discomfort and balloon will not inflate as well no urine return. This finding may indicate that increased nurses' knowledge will help them to take a correct decision for any obstacles during urinary catheterization practice.

This result was in agreement with a study by **Willson et al. (2009)** who reported that nurses are often responsible for the initiation of catheterization procedures for patients within the hospital and nurse' role requires contemporary information on catheter selection and problem solving in the maintenance of urinary catheters technique. In another congruent recent study by **Mizerek and Wolf (2014)**, it was revealed that decision making with regard to catheter placement is reported as being under the purview of nursing. It may be important to reformat education and competency to include observational evaluations of decision making with regard to appropriate indications for insertion; validation of insertion techniques may be important as well.

In the same issue **Martin (2012)** found that, nurses' perceptions of urinary catheters are different from health service to others. He emphasized that nursing practices in catheter management vary widely and frequently and the effective nursing measures include, identifying patients who no longer need indwelling catheters, discussing appropriate catheter alternatives.

As regards nurses' attitude towards urinary catheterization practices, the current study showed that post implementing the workshop; the percentage of positive responses were increased as regards all items. This finding indicated that, as nurses became knowledgeable and skillful, they showed more positive attitude towards managing urinary catheter perfectly and safely. **Kim et al. (2015)** emphasized that changing behavior towards urinary catheter practices come through education and renewed CAUTI awareness of nurses.

In the same point, **Oman et al. (2011)** Stated that, changing provider behavior is a challenge across all healthcare settings. He found that the early engagement of nurses with a targeted educational interdisciplinary initiative led to increased awareness of the presence of IUCs, including the concepts of QI. This result stressed the positive relation between nurses' knowledge and their behavior or attitude towards urinary catheter management.

Conclusion:

In the light of the current study; it can be concluded that, there was a highly significant difference between knowledge and practice pre/post and one month later after implementing the interactive workshop. Also there was a correlation between nurses' knowledge and practices after the workshop. As well, nurses' perception regarding expected urinary catheter complications and ability of them to solve problem through correct potential solution in each situation were significantly increased post workshop. Furthermore, a positive improvement was noticed as regards their attitude towards urinary catheter practices post workshop.

Recommendations:

Based on these findings, it is recommended to:

- Implement this developed interactive workshop on other groups of nurses in order to improve their knowledge, practice and perception of managing indwelling urinary catheters.
- Test perception of newly working nurses regarding urinary catheter management.
- Consider results of this study as a valuable baseline for further researches for evidence of results and generalization.

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