

Effects of Nursing Intervention on Minimizing Complications among Patients having Percutaneous Nephrostomy Tube Visiting the Institute of Kidney Diseases, Peshawar

A Quasi Experimental Study

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Abstract

Background: Kidney stones affect 1-5% of the global population, with varying rates in Asia, Europe, and North America. Image-guided nephrostomy tubes are used to relieve obstruction and provide drainage, with health workers aiming to reduce complications. **Objective:** The study was conducted to determine the impact of nursing guidelines to minimize complications associated with percutaneous nephrostomy tube. **Materials and Method:** This quasi experimental study aimed to identify the pre and post-intervention impact of a 15-item questionnaire on patients at the Institute of Kidney Disease (IKD) Peshawar for PCN tube procedures. The study involved three steps: pre-intervention assessment, intervention sessions, and post-intervention data collection. Descriptive statistics were calculated, and inferential status was determined using paired t-test and chi-square test. The study was approved by the Ethical Review Board and Advance Studies Research Board, with informed consent and patient rights. **Results:** The study found that the majority of participants were female (51.9%), aged 31-40 years, married (72%), educated (38.9%), and had PCN intact for 1 month. Most patients never attended PCN workshops/courses. The intervention was effective, with a significant p-value (0.000) indicating better patient practices. The majority of patients had poor practices in pre-test (57%). **Conclusion:** Based on the findings of the study, it is possible to draw the conclusion that the educational guidelines significantly improved patient performance with regard to percutaneous nephrostomy tubes. The checklist should use in every clinical setting to handover patient before the procedure that they implement the simple steps to minimize complications.

Keywords: Complication, Intervention, Educational Guidelines, Percutaneous Nephrostomy Tube.

INTRODUCTION

When normal flow is disrupted, a nephrostomy is a surgical opening made between the kidney and the skin that allows urine to be drained directly from the upper part of the urinary system [1]. Preoperative complications are rare with percutaneous nephrostomy tube, but they are typically associated with lower morbidity and mortality [2]. The severity of post-procedure bleeding can range from mild, brief hematuria to severe hemorrhage that necessitates transfusion or intervention [3].

With adequate urinary drainage, small tears and leaks stopped on their own. Pneumonia and atelectasis are two other minor complications [4]. Throughout the procedure, vascular injury may be associated with hemorrhage. Injured vessels can be ligated to capture the dying, or as an end resort, fractional or general nephrostomy may also must be done [5]. Septic shock is a serious complication that has been shown in some published case series to be a factor in patient mortality [6]. Another rare but unquestionably serious side effect of percutaneous nephrostomy is bowel transgression, which is said to occur in 0.2 to 0.3 percent of cases [7].

One of the most common interventional procedures is the percutaneous nephrostomy (PCN), which is done to divert urine from an obstructed collecting system or as a prelude to procedures like stent placement, endoscopy, or percutaneous nephrolithotripsy (PCNL) [8]. Willard Goodwin was the first urologist who places the percutaneous nephrostomy tube; later in 1955 Goodwin and Casey performed the procedure and place a percutaneous lumbar tap of the renal pelvis for temporary urinary drainage [9].

In 1965, Bartley described a method for using a permanent drain. He used a modified Seldinger technique and used an angiography catheter to relieve pressure on the renal pelvis [10]. The first report of an ultrasound-guided percutaneous nephrostomy was published in 1974, while in 1980, Cope introduced the Cope loop catheter, which has a distal loop that is shaped like a loop in the renal pelvis [11].

The most common reason for PCN treatment is draining the collecting system. Urinary tract obstruction can be caused by either intrinsic or extrinsic factors like stones, cancer, pregnancy, or iatrogenic disorders. Urinary track stones are the cause of blockage in over half of these cases, and these patients with pyonephrosis need an intense PCN because of the great risk of Gram-negative sepsis. [8].

Globally 1-15% of the population is suffering from kidney stones that became a major cause to patient morbidity [12]; moreover this rate is reported as 1–5% in Asia, 5–9% in Europe, and 7–15% in North America [13]. Nurses play vital role for the preparation of patient for the procedure and then to receive patient after the procedure to assess the patient for 24 hours.

Nurses should observe the risk associated with the procedure in the form of bleeding from the insertion site or from the dressing, monitor vital signs, tube misplacement, fever, pain and localize infection [14]. Furthermore nurses monitor the patient to take necessary actions to minimize the risk of complications.

Nurses require specialize training to maintain the principles of care within the hospital and also teach the patient about the necessary action at the time of discharge. Based on the needs of patient relevant to the procedure an intervention was designed that will be deliver to the nurses and to evaluate its effectiveness.

METHODOLOGY

Study Design

A Quasi Experimental (Pre-and Post-Test) Study Design will be used to carry out the current study. Quasi experimental study is not truly experimental but resembles experimental research, where Participants are not randomly assigned to conditions or orders of conditions [15]. To evaluate the effectiveness of nursing guidelines to minimize the complication associated with PCN tube, a quantitative Quasi-experimental pre-test and post-test study design was suitable. Be that as it may, they miss the mark on components of a completely trial plan. Mostly, they do not randomly assign participants to study groups [16].

The study population was the patient who is admitted for percutaneous nephrostomy tube. The study setting was Institute of Kidney Disease (IKD) Hayatabad Peshawar. Institute of kidney diseases is located in Peshawar that is the capital of Khyber pukhtankhwa Pakistan and one of the largest cities of the country.

Sample size for the study was calculated through G-Power sample size calculator. With effect size of 0.5, alpha error 0.05 and power of study 0.95 sample size for the study comes to be 54 using purposive sampling technique that was conducted from March 2023 to June 2023. The inclusion and exclusion criteria of the study were:

Inclusion Criteria:

- All those Patients who have PCN tube will be included in this study.
- Both male and female patient with age between 18-65 years.

Exclusion Criteria:

- Patients who are having already complications, mentally unstable and not stable.
- Patients who are not willing to be participate in the study.

Study Tool

The following tools were used for data collection:

A. (Demographic data): Gender, Age, marital status, education, occupation.

B. Nursing guidelines: An adopted questionnaire that contain 15 items.

Nursing guidelines Checklist: it is 15 item checklists with dichotomous response of (correct/incorrect). The checklist was prepared with the help of previous published literature that are validated by 3 nephrologists and after conducting a pilot study the content validity index of the checklist was 0.91.

Nursing Guidelines Intervention Program

The nursing guidelines intervention contain two sessions.

The first step was to assess the patient for the inclusion criteria and if patient is willing to be the voluntary participant of the study, informed consent was collected.

The second step (**Intervention phase**) contain the two sessions (45 minutes each) that are:

1. The first session was conducted 24 hours before the surgery that contains the information regarding the PCN tube insertion, its purpose, its care and possible complications.
2. The 2nd session was conducted 24 hours after the surgery that contain the information regarding the self-care practices (skin care, hand washing, increase water intake, empty bag when full, care of tube and dressing), and after discharge to keep bag safely to prevent from blockage, monitor temperature, keep medication, sleep on opposite side of tube, avoid weight lifting and clean the dressing site with antiseptic solution.

Study Protocol

The study was approved by the ethical review board and advance research studies board of Khyber medical university. The primary investigator trained two nurses for two weeks for research intervention that was provided by the hospital administration on the researcher request. The primary

investigator makes their availability during data collection in case of any need from the assistant or patient to facilitate them.

Therefore when the patient was admitted in the ward was approached by the research assistant as a pre-operative patient. Research assistant assess and examine the patient for inclusion criteria, then the purpose, duration and objective of the study was explain to each participant in the presence of their attendant.

After signing the informed consent the patient was included as the study participant. The research assistant provides the checklist for the assessment of patient regarding PCN tube as pre-test, and checked it later for any missing data. Then the intervention was delivered to each patient individually and after two weeks the patient was assessed again through same checklist as post-test.

Data Collection Procedure

The program was divided into three phases:

1. **Pre-intervention:** Pre-test of prevention of infections and complications of percutaneous nephrostomy tube checklist was filled.
2. **Intervention:** two Sessions that contain education about prevention of infections and minimize complications among percutaneous nephrostomy tube patients.
3. **Post-Intervention:** After 2 week post-test data was collected.

Data Analysis Procedure

Statistical software SPSS version 24.0 will be used for data analysis. Descriptive statistics will be used to calculate percentages and frequencies. Mean and standard deviation will be used for the computation of continuous variables while frequencies and percentages will be used for the categorical variables. Furthermore to draw the conclusions and inferences inferential statistics will be used.

Inferential Statistics:

Paired t-test will be used to compare the mean scores in pre and posttest phases. Chi square test will be used to assess the association of means score within the categorical variables. Other statistical tests will be applied accordingly.

Variables Categorization:

The total items of the checklist was 15, where for correct was number as 1, and incorrect mark 0. The checklist was categorized as best practices (11 and above), average practices (7-10) and 6 and low was the weak practices.

Ethical Consideration

The Ethical review board (ERB) and Advance studies research board (ASRB) approves the research proposal. There were no direct benefit and risk for the patient during the research project. The study was conducted in accordance with clinical research ethics complies with the Declaration of Helsinki.

After explaining the study's goal, formal informed consent is obtained from patients or guidance that is willing to participate. The subject of the study has the right to withdraw from the study at any time without explanation, and privacy concerns have been taken into account when collecting data.

RESULTS

Demographic data of the patients

In the current study the total number of participants was 54, where the number of female

Table 1: Demographic Data of the Participants

Variables		Frequency(n) 54	Percentage (%)
Gender	Male	26	48.1%
	Female	28	51.9%
Age Mean (43.0 ± 16.7)	20 years and below	4	7.4 %
	21 -30 Years	10	18.5 %
	31 – 40 years	13	24 %
	41 – 50 years	10	18.5 %
	51 and 60 years	10	18.5 %
	61 and above	7	12.9 %
Marital status	Single	15	28 %
	Married	39	72 %
Employment	Employee	30	55.6 %
	Not-Employee	24	44.4 %
Educational status	Illustrate	9	16.7 %
	Primary	21	38.9 %
	Higher	3	5.6 %
	Secondary	13	24.1 %
	University	8	14.8 %
Duration of PCN tube intact	14 days	6	11.1 %
	21 days	4	7.4 %
	1 month	24	44.4 %
	2 month	16	29.6 %
	3 month	4	7.4 %
Have you received PCN training?	Yes	4	7.4 %
	No	50	92.6 %

Assessments of Patient Practices through Checklist

The checklist contains 15 items with Correct/Incorrect response, so correct having 1 number while incorrect practice was labeled as 0.

The checklist show that patient self-care practices were improved as a result of nursing intervention and Nurse-led nursing guidelines intervention was effective. In item 1 and 2 it was the basics for every procedure so in pre-test and in post-test there was not significant positive improvement while the result of steps taken for minimal complication show improvement in the patient practice (see table 2).

Table 2 illustrates that the pre-test overall score of the patients were increased (0.42 ± 0.1) in post-test score (0.86 ± 0.0). As a result the paired t-test score of the study show (0.000) that the intervention of nursing guidelines were significantly positive effective that minimize the possibility of complications.

Table 2: Evaluation of Pre-Test and Post-Test Score of the Study Participants

S No	Steps	Pre-test	Post-test	P-value
1	Washed hands with soap and water and Wore gloves before handlethe nephrostomy tube	1.0 ± 0.0	1.0 ± 0.0	0.39
2	Collected equipment's nearby clean surface for nephrostomy tube dressing. Removed and discarded the old bandages and dressing.	1.0 ± 0.0	0.98 ± 0.13	0.32
3	Washed hands and wore gloves after removing the contaminated dressing.	0.37 ± 0.4	0.92 ± 0.2	0.000
4	Used pyodine solution for scrubbing back and forth motion around the exit site for 30 second and in circular Allowed air to dry skin for60second.	0.18 ± 0.3	0.88 ± 0.3	0.000
5	Placed sterile gauze around the tube and applied tegaderm tape over the tubein aseptic technique.	0.29 ± 0.4	0.79 ± 0.4	0.000
6	Checked drainage tube is patent and not kinked or bent.	0.27 ± 0.4	0.83 ± 0.3	0.000
7	Kept the drainage bag lower than renal preventing from urine backing up.	0.31 ± 0.4	0.68 ± 0.4	0.000
8	Cleaned the bag after removing it from the tube and used another bottle to collect urine while clean the bag.	0.35 ± 0.4	0.79 ± 0.4	0.000
9	All urine specimen must be collected from nephrostomy tube by gravitynot use aspiration	0.25 ± 0.4	0.75 ± 0.4	0.000
10	Emptied the drainage bag before it is completely full or every 2 and 3 hours	0.29 ± 0.4	0.88 ± 0.3	0.000
11	Observed for leakage at connection joints and seek advice if leakage evident.	0.40 ± 0.4	0.87 ± 0.3	0.000
12	Knew to Irrigate of nephrostomy is require if there is no urine, remainsheavily blood stained , suspected blockage or flank pain	0.46 ± 0.5	0.85 ± 0.3	0.000
13	Flush not more than 10 ml of sterile normal saline	0.33 ± 0.4	0.92 ± 0.2	0.000
14	Did with deep breathing exercise to reduce with pulmonary complication	0.16 ± 0.3	0.83 ± 0.3	0.000
15	Removed gloves and washed hand after procedure.	0.62 ± 0.4	1.0 ± 0.0	0.000
Overall		0.42 ± 0.1	0.86 ± 0.0	0.000

Comparison of Pre-test and Post-test Score (Cutoff Values)

Table 3 illustrate the comparison of pre-test and post-test number of participants that reveals that number of best practices patient in pre-test was only 3 that increased to 54 in post-test, while in pre-test the number of patients was 31 that decrease to 0 as a result of intervention.

Table 3: Pre-test and Post-test score compare to cutoff values

	Best practices (11 and above) score	Average practices (7-10) score	Poor practices 6 and below
Pre-test	3 (6%)	20 (37%)	31 (57%)
Post-test	54 (100%)	0	0

Association of patient practices of PCN tube with demographic variables

The patient practices of pre-test were calculated with selected variables of the categorical variables of demographic variables through chi-square test.

Table 4: Association of Patient Practices with Selected Variables

	Age	Age	Marital status	Employment	PCN Training	PCN duration
Patient practices	0.245	0.482	0.926	0.142	0.005	0.564

DISCUSSION

In the current study the total number of participants was 54, where the number of female participants was higher n-28 (51.9%) than male patient's n-26 (48.1%). While a study conducted in 2023 shows that majority of the study participants were female (70%) compare to male patient that was in line with our findings [17]. Another study conducted in 2022 show different result where the number of male patients was higher (70%) than female patients (30%) [18]. Other studies have also report different findings from our study, where the number of male patients was higher (56%) (61.7%) (66.7%) (70%) than female patient [19, 20, 21, 22]

As a primary investigator attending an educational program keeps nurses' knowledge up to date, improves staff skills, and teaches them how to work effectively in an emergency and wards that will help the attendant of the patients, and patient by self to learn from the nurses for self-care practices of patient that will minimize the chances of infection and complications. Other researcher also suggests that educational and demonstrative training is very important for the care-givers. According to Finkelman & Kenner, (2013) that professional education and training had an effect on nurses' knowledge [23]. The participant of the present study show that majority of the participants doesn't received PCN tube training (92.6%), while only (7.4%) received training. Our findings are congruent with the study of Mohamed et al. (2023) where the maximum number of patient doesn't receive any training, the study researcher also suggest that knowledge and skills for the management of PCN is very important that improve the skills of nurses and will impact of the outcome of patient [17]. Jihad & Reda, (2018) findings reveals that a very little amount of their study participants have received training about the care and management of PCN [24].

The present study report that the post-test score of the study was increased (0.86 ± 0.0) compare to the pre-test score (0.42 ± 0.1) of the participant, that clearly indicate that the intervention was effective and shows a statistical difference (0.000). Furthermore, the study reveals that the practices of patient were improved from the start of the procedure like washing the hands, wearing gloves and collect the instrument required. The improvement also occur in the patient practices regarding the antiseptic solution, using of sterile gauze, prevent the tube from bending, keep the drainage lower, clean the tube, collection of specimen, empty the bag, observation of leakage, flush with normal saline, and change of bag. In the current study it was observed that majority of the patient doesn't have knowledge about the minor and major complications associated with PCN tube. In the pre-test majority of the patient (67%) of the patient doesn't know when to empty the bag of PCN tube. It is also necessary to collect that urine for 24 hours. Studies suggest that 3-4 hourly the bag should be emptied, or if the bag is filled before these hours [25]. Kwong et al (2020) was in line with our findings that 24 hourly it is necessary to monitor the output of the patient [26]. While McDonald et al (2021) recommend that the monitoring of urine output color is important [27].

The study demonstrate that patient who will monitor the tube for bending and kinking will decrease the risk of blockage and dislodging, and in long term will decrease the risk of bleeding from the procedural site. The findings are similar with the study of Azer et al (2018) that report that the nursing guidelines intervention minimizes the incident of bleeding [21], that are also support by the study of Dagli et al (2011) who reveal that bleeding associated complication could be reduced through pre-procedural intervention [28].

As regarding the complications the current study revealed that there was statistically significance difference between the intervention and control group. The minor complication is common than major complications, therefore fever, hematuria, and pain were observed in (17%) of the patients. Other studies reveals minor complications like 27.2% minor complications associated with urinary tract infection and dislodgment of tube reported by Kumar, et al.(2020) [29].

The findings reveal that the intervention was effective because there is a statistical difference between control and intervention regarding minimizing the chances of complication. The findings are in line with the study that demonstrates that the level patients' information in concentrate on bunch was improved altogether and prompted high stone free rate, lower complications and profoundly critical enhancement for quality of life [22]. The study of Ritz et al.'s (2016) also demonstrate that, prior to the implementation of CCC, 15 of the 32 adult patients with PCNs (46.9%) experienced complications that required hospitalization, whereas post-implementation, only 2 of the 47 PCN catheter patients (4.3%) experienced complications that necessitated hospitalization. And came to the conclusion that the development of a CCC improved PCN patients' outcomes, as evidenced by a reduction in emergency department visits and inpatient stays, as well as reduced hospital costs [30]. The study of Mohamed et al (2023) demonstrates that the successful implementation of structured educational guidelines was a successful method of increasing nurses' practice with regard to percutaneous nephrostomy tubes, which indicates that the implementation of educational guidelines was successful [17]. Jihad & Reda (2018) report that during the pre-test phase of the educational guidelines' implementation, the majority of participating nurses had unsatisfied practice levels regarding nursing management of patients with percutaneous nephrostomy tubes. On the other hand, post-test results showed that nurses' practices levels had improved to a level that was satisfied [24]. Mohamed et al 2022 reveal that concerning postoperative inconveniences; Patients' tube complications did not differ statistically between the study and control groups, according to this study. There was no skin complication present and with respect to tube entanglement was slipping among intervention participants however bleeding among control bunch [18]. Azer et al 2018 It was observed that, when it came to the occurrence of minor complications during hospitalization, both the patients in the study and those in the control group; After two and four weeks of following the nursing guidelines, there was a statistically significant difference between the two groups in terms of transient hematuria, pain, and fever [21]. Dagli et al (2011) reported that bleeding complications can be minimized by appropriate pre-procedural preparation support our study's finding that patients in the study group had a lower incidence of bleeding than those in the control group [28].

The present study explore the comparison of pre-test and post-test number of participants that reveals that number of best practices patient in pre-test was only 3 (6%) that increased to 54 (100%) in post-test, while in pre-test the number of patients was 31 (57%) that decrease to 0 (0%) as a result of intervention. Therefore the findings indicate the effectiveness of nursing guidelines intervention applied by the primary researcher.

Supporting our findings the study conducted by Ali et al. (2023) demonstrate that Pre-intervention level knowledge and PCN tube self-care practice did not differ significantly between the study and control groups, according to the current study's findings. However, post-intervention, there was a statistically significant difference between the two groups, indicating the effectiveness of the provided educational intervention [31].

Likewise the study conducted by Mohamed & Fashafsheh (2019) demonstrated that prior to implementation; there was no statistically significant difference between the two groups. In contrast to the control group, which received standard care, there was a statistically significant improvement in knowledge and self-care performance in the study group at the initial and subsequent tests. [32]. Furthermore In this framework, Chen et al. (2020) stated that patients' knowledge may influence both self-care and self-efficacy. Poor knowledge of the condition may make it difficult to recognize and evaluate symptoms, which in turn may lead to less self-care and lower confidence (self-efficacy) in responding to symptoms [33].

The result is also well-match with the study of Mohamed et al. (2023) that reveals the findings that their study substantiated the existence of highly statistically significant knowledge scores differences among the study nurses. During the educational guidelines' pre-implementation phase, approximately half of the nurses had limited knowledge of the anatomy and physiology of the urinary tract, the percutaneous nephrostomy tube, and post-operative nursing care for patients with percutaneous nephrostomy. However, after the educational guidelines were implemented, this proportion increased, and the majority of nurses became more oriented and knowledgeable about percutaneous nephrostomy [18]. The result is also comparable with the study of Abd el-fattah, et al. (2015) reveals that, following the implementation of the educational guidelines, half of the participating nurses had a low level of knowledge about percutaneous nephrostomy tubes, one third had a fair level and less than one fifth had a good level [34]. Another study was also in line with our findings that reveal that at the time of assessment in our study, all patients in the study and control groups lacked a satisfactory level of knowledge about percutaneous nephrolithotomy. This is because the health care team did not provide patients with sufficient information about their conditions. Many different complications and negative effects on quality of life can result from ignorance regarding medications, diet, wound care, rest, and activity [14]. Oyira, et al., 2016 study emphasized that the significance of knowledge in the provision of high-quality nursing care by nurses at the University of Calabar Teaching Hospital [35].

The current study report that patient practices is not associated with gender, age, marital status, employment status, and duration of intact PCN tube. While only associated with the training they conducted in past regarding PCN tube. A study report that statistical significant differences were found between age, educational level, occupation, residence, cause of obstruction with patient's total self-care practice classes [21]. Another study reveals that, there was a statistically significant relationship between older age and cases with complications and a high score of knowledge among patients with a university level of education. Furthermore the study showed a statistically significant positive correlation between the knowledge score before the implementation of the nursing guidelines and both the practice score before and after, indicating that an increase in knowledge will be correlated with an increase in practice level [32].

CONCLUSION

The study concluded that the patient with percutaneous nephrostomy tube practices in the post-test was higher and the difference was significant (0.000) compared to pre-test. It means that as a result of nursing guidelines intervention the patients learn that how to use anti-septic solution application on the tube site, use of surgical gauzes on tube site, check tube for blockage, draining on gravity, collection of urine specimen, flushing the tube, the use of deep breathing exercise to minimize complications that determine that the intervention was effective.

Based on the findings of the study, it is possible to draw the conclusion that the educational guidelines significantly improved patient performance with regard to percutaneous nephrostomy tubes. Before and after patient received educational guidelines regarding the percutaneous nephrostomy tube, there was a highly statistically significant positive correlation between their total knowledge scores and their total practice scores.

Postoperative complications and ineffective self-care practices were significantly reduced or prevented by providing nursing interventions and increasing patients' knowledge. In this way, patients after percutaneous nephrostomy tube are in fundamental requirement for extraordinary nursing mediations and schooling to assist them with staying away from numerous postoperative entanglements and accordingly work on their wellbeing.

Implication in Clinical Practices

1. A clinical session by the urology team or the nursing education services should arrange a workshop for the implementation of these guidelines.
2. The study guidelines should be provided to the nursing staff in the form of three steps that we followed in the study, that they implement it on their patient and provide a hard form to the patient in during discharge.
3. The checklist used in the study could be used in English or translated in to Urdu, and that could be used in every clinical setting to handover patient before the patient procedure that they understand and implement the simple steps to minimize associated complications.

Limitations of the study

The study is certain limitation in which

1. The study lacks a control group for comparison.
2. I consider that the study lack to explore the co-morbid associated with diseases process.
3. The study also lacks the complication symptoms and its statistical analysis that how much people were assessed for minor and major complications in pre-and post-test.
4. The study doesn't address the barriers that prevent patient from practices to minimize compilation.
5. The study is conducted in one province of the country; therefore the findings could not be generalized for the entire nation.
6. The study doesn't address the tube size of the patient and different technique of PCN tube.

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