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Demographic And Clinical Factors Shaping CAUTI Risk: Insights From A Control Group Of Catheterized Patients

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Abstract

Catheter-associated urinary tract infection (CAUTI) is a significant topic in hospitalized patients, and the patient characteristics take a key role on risk determination. The knowledge of the profile of catheterized patients not developing CAUTI can facilitate a clearer grasp of the factors that can influence the process of achieving the infection-free outcomes. To present demographic and clinical features of patients in the control group having urinary catheters and find patterns that are applicable to the prevention of CAUTI. A descriptive observational study was done on 200 catheterized adults in a tertiary care hospital. The demographic variables were age, marital status, education, occupation and residence. Some of the clinical variables were diagnosis, postoperative surgery, and BMI. The analysis of data was based on the use of descriptive statistics and independent t-tests. The majority of the patients were aged between 20 and 50 years with the gender distribution close to equal. The majority consisted of married patients, those with secondary or university level of education and individuals residing in the urban areas. The most common diagnosis was urinary retention, which was then followed by urinary incontinence and bladder management after surgery. The most common postoperative surgeries included Prostatectomy and pelvic surgery. The patterns of BMI indicated that there were a higher number of overweight people. The independent t-tests showed significant differences in all the demographic and clinical variables ($p < .05$).The results indicate a vivid demographic and clinical characterization of catheterized patients who were not exposed to CAUTI. The characteristics are able to facilitate tailored preventive measures and more careful catheter management practices in healthcare facilities.

Keywords: Catheter-associated urinary tract infection, Sociodemographic, Diagnosis, Body Mass index

1. INTRODUCTION

Catheter-associated urinary tract infection (CAUTI) is a type of healthcare-associated infection that ranks among the most prevalent instances of urinary infections in hospitals and is responsible almost half of all healthcare-associated urinary infections (Hooton et al., 2010). The risk is greater based on the length of catheterization, underlying clinical factors and characteristics of the patient including age, mobility and comorbidities(Letica-Kriegel et al., 2019). Long catheterization disturbs the normal urinary stream and has a direct pathway to the bladder which is a high-risk group of patients under catheterization (CDC, 2019). The patient at risk is those who are post operating and are undergoing prostatectomy, cystectomy or surgery of the pelvis, as they are also likely to be catheterized to drain the bladder, increasing the risk further (Feneley et al., 2015). The analysis of demographic and clinical trends among catheterized patients without CAUTI can be of importance in revealing the protective factors and to inform prevention strategies. Such aspects as age distribution, BMI, residence, occupation and type of surgery could determine the potential risk of infection and allow clinicians to estimate the risk more precisely (Saint et al., 2016, Li et al., 2025). Assessment of these attributes will offer necessary background information on the comparison of control patients compared to the patients who ultimately contract CAUTI.

This paper discusses the demographic characteristics of patients in the control group who have urinary catheters in terms of diagnosis, postoperative surgery and BMI. Learning these baseline features serves to identify patient groups that can be used to prevent and also prevents catheter use in a safer fashion.

2. METHODOLOGY

2.1Study Design

The descriptive observational design was employed to look at the demographic and clinical features of patients with the control group (n = 200) who were necessitating urinary catheterization due to different medical or postoperative purposes. The design was aimed at knowing the age, gender, marital status, education, occupation and residence, and diagnosis, type of surgery, and BMI distribution. Because no intervention was used it was possible to systematically measure patient characteristics in normal care using the design. This was done to create a comprehensive baseline profile of catheterized patients that do not get CAUTI that can be used to further compare with affected groups.

2.2 Setting and Population of the study.

The research was undertaken at a tertiary care hospital that gives high-level medical and surgical care. The target population was 200 adults over the age of 20 years who had an indwelling urinary catheter but did not get catheter-associated urinary tract infection. The inclusion criteria were catheterization due to urinary retention, catheterization due to urinary incontinence or postoperative management of the bladder. Individuals whose urinary tract infection has been confirmed during admission or whose clinical data was incomplete were excluded. The study also sought to assess demographic and clinical variables common among cathetered patients who did not get infected by concentrating on this group.

3.3 Data Collection Procedure

Electronic medical records and structured extraction sheets were used to get data of all 200 control group patients. The demographic information covered the age, gender, marital status, education, occupation and residence. Primary diagnosis, postoperative surgery type and BMI were in clinical information. The data was checked to be complete and records were reviewed carefully and then analyzed. The extraction technique guaranteed consistency of all entries eliminating variability due to the different documentation styles. Confidentiality of patients was ensured during study. The organized process of collection presented a quality dataset to study the features of the catheterized patients who never had CAUTI.

2.4 Study Variables

The 200 control group patients were divided into variables that included demographic and clinical groups. Demographic factors involved age groups and gender, marital status, education, occupation and residence place. The clinical variables were diagnosis that resulted in catheterization, postoperative surgery like prostatectomy, cystectomy or pelvic surgery and BMI of classification. These variables were identified according to their relevance to the CAUTI risk factors in clinical practice. Their combination helped to create the full picture of the control group, contributing to the identification of the features that can distinguish between the patients who are infection-free and those who contract CAUTI.

2.5 Statistical Analysis

The categorical data were described using frequencies and percentages. To determine data distribution, variance, skew and kurtosis were calculated. Independent t-tests were used to investigate the difference by the demographic and clinical variables. A p-value of below.05 was decided to be of significant statistical value. Standard statistical software was used to conduct all the analyses.

3. RESULT AND DISCUSSION

The control population was also demographically represented with the majority of the participants aged between 41 and 50 years (37.5 percent)(Table 1). Age group of 20 to 30 years took up 34.5 percent and that of 31 to 40 years constituted 28 percent. The values of age variance and negative kurtosis show that there is dispersion and not a concentration around a particular age range. This trend is consistent with previous reports that indicate that the adult and middle-aged population groups are usually represented in comparative studies of CAUTI patients and non-infected controls (Saint et al., 2016).The gender representation was even and 48.5 percent of the sample was female and 51.5 percent male. The skewness is slightly negative and the variance is low indicating equal distribution between the two sexes. The balanced control group is also essential due to the fact that CAUTI may act in different ways in both sexes based on the length of stay in the catheter, comorbidities, and hospitalization rates but both sexes are valid comparison groups provided that proportions are equal (Meddings et al., 2019). The marital status revealed that 61 percent of the group were married whereas 26.5 percent were single and small percentages divorced or widowed. The variance was low and the negative kurtosis indicates what is expected of an adult population. Age trends and social demographics have also shown married people as the most significant subgroup in studies of adult samples based in a hospital setting (Gould et al., 2017).There was a broad range of educational status whereby 25 percent were university holders and 19.5 percent illiterate. The significant value of variance (2.173) indicates that there are significant differences in the education level among the group. This diversity matter since the educational background can affect the knowledge of infection prevention measures and health behavior that is frequently discussed during the CAUTI-related education programs (Tenke et al., 2017).The occupational status was spread between the unemployed (31.5 percent), sedentary (36 percent), and the employed (32.5 percent). The medium variance shows that the group had people with varying amounts of mobility and daily activity. These determinants may have an indirect impact on the catheter utilization trends, general health condition, and the risk of hospitalization, which are accepted factors in CAUTI-related studies (Chenoweth & Saint, 2013). In terms of the residence place, 56 percent in urban regions, and 44 percent in rural areas. The urban predominance is mild due to the slight negative skew. In hospital based control groups, urban representation is usual since urban inhabitants are usually more prone to tertiary care in which indwelling catheter exploitation is more widespread (Hooton et al., 2010).In general, the demographic features of the control group indicate an equal and diverse sample that would be appropriate to compare with CAUTI patients. The balance of the genders, diversification of educational background and the spread of the occupational and residential groups are helpful to make sure that the disparities in the clinical results are not caused by the unequalization of the populations but rather to the presence or lack of catheter-associated infection.

Table 1: Demographic features of the patients in the control group

	Frequency	%	Variance	Skewness	Kurtosis
Age					
20 to 30	69	34.5	0.723	-0.057	-1.617
31 to 40	56	28.0			
41 to 50	75	37.5			
Gender					
Female	97	48.5	0.251	-0.06	-2.02
Male	103	51.5			
Marital status					
Single	53	26.5	0.232	-0.153	-1.82
Married	122	61.0			
Divorced	15	7.5			
Widow	10	5.0			
Education					
Illiterate	39	19.5	2.173	-0.096	-1.404
Read and write	39	19.5			
Primary	32	16.0			
Secondary	40	20.0			
University	50	25.0			
Occupation					
Unemployed	63	31.5	0.643	-0.018	-1.443
Sedentary	72	36.0			
Employee	65	32.5			
Residence					
Rural	88	44.0	0.248	-0.244	-1.96
Urban	112	56.0			

Table 2: Diagnostic Reasons for Catheterization in the CAUTI Study Group

Particulars	**Frequency**	**%**	Variance	Skewness	Kurtosis
Diagnosis					
Urinary retention	74	37.0	0.685	0.103	-1.535
Urinary incontinence	63	31.5			
Post-operative bladder management	63	31.5			

The clinical diagnosis of the case that needed catheterization is given Table 2. The most frequent sign was urinary retention, and it was found in 37 percent of cases. The skewness and 1 variance indicated that (retention) was more prevalent than the other diagnoses, but the distribution was generally quite even. Urinary retention can also frequently be cited as a major cause of catheter insertion particularly in old adults and patients with obstructive urology (Hooton et al., 2010). The analysis also found urinary incontinence and post-operative bladder management to be the causes of 31.5 percent of its cases. These results are consistent with the common practice in hospitals where catheters are used to short-term treat the postoperative drainage of the urine and in rare instances of incontinence when other treatment options are not applicable. The same proportions have also been characterized in previous studies, and postoperative catheterization is highlighted as one of the most common indications in surgical units (Tenke et al., 2017). The value of kurtosis in urinary retention is equal to zero, which implies that the distribution was not sharp-peaked. It is in line with clinical

findings that retention is apparent over a wide age group and among patients with different comorbidities. The three-way distribution of retention, incontinence, and postoperative needs is overall consistent with the reports that indicate that there is no one leading cause of catheters; instead, it is associated with several categories of diagnostics (Gould et al., 2017). It is significant to know the diagnostic signs since each of the conditions will have varying risks related to catheter-associated urinary tract infection (CAUTI). The prolonged use of catheters is a well-known risk factor that leads to infection, and is common with retention and postoperative drainage. The results of the study support the significance of cautious consideration of the need to introduce a catheter and immediately discharge policies to minimize the rates of CAUTI (Saint et al., 2016).

Table 3: Distribution of Surgical Procedures Leading to Post-operative Catheterization

Particulars	Frequency	%	Variance	Skewness	Kurtosis
Surgery post-operative					
Prostatectomy	78	39.0	0.742	0.077	-1.653
Cystectomy	52	26.0			
pelvic surgery	70	35.0			

Table 3 demonstrates the surgical operations where the catheterization was necessary in the post-operative stage. Prostatectomy had the highest relative percentage of 39 percent with the moderate degree of variance and a small degree of positive skew meaning that it was more prevalent than the other procedures. This is in line with the previous results that prostate surgeries often entail temporary catheterization due to bladder outlet hindrance and controlled urine outflow following the operation

The cases of pelvic surgeries comprised 35 percent. These operations usually entail manipulation around the bladder and urethra and most of the patients need catheter support in the early post-operative phase. The same percentages have been reported in surgical wards where 26 percent of the group was subject to cystectomy (Tenke et al., 2017). Cystectomy is not common as prostatectomy and pelvic surgeries, but it normally takes a longer period of catheterization as it involves reconstruction of the urinary tract and close attention to the urine output. It is in line with reports of major urological surgery increasing catheter dwell time, which has been reported as a risk factor of CAUTI .The general distribution demonstrates that a combination of major urological and pelvic surgery is what drives catheter use. The significance of understanding these patterns is that post-operative catheterization is one of the most frequently used clinical courses that result in CAUTI, especially in cases when the time of catheter stay is extended prompt catheterization removals.

Table 4: Distribution of Body Mass Index (BMI)

Particulars	Frequency	%	Variance	Skewness	Kurtosis
BMI					
Underweight	33	16.5	0.608	-0.097	-1.142
Normal	61	30.5			
Overweight	74	37			
Obesity	32	16			

A description of BMI distribution of the patients is given in Table 4. The highest percentage was obtained in overweight individuals 37 percent with the normal BMI of 30.5 percent coming behind. The value of variance is moderate, and negative kurtosis indicates a flatter distribution, and hence patients were evenly distributed among the categories of BMI, and they were not concentrated in one point. It follows the previous hospital-based research in which the proportion of overweight adults constitutes a high percentage of patients with catheters (Meddings et al., 2019).Underweight and obese patients constituted 16.5 percent and 16 percent, respectively. Despite the fact that, both groups are minor in terms of percentage, they are of clinical significance since alterations with normal BMI are linked to weakened immunity, slowing recovery, and extended hospitalization. These variables may indirectly raise the increase in the time of catheter exposure and the CAUTI risk (Gould et al., 2017).The negative skew was a minor effect, which is consistent with the results of other works presenting the idea that overweight and obese patients are more susceptible to having

surgical and medical procedures that require catheterization (Tenke et al., 2017). High BMI has been additionally associated with decreased mobility, which can further put CAUTI at risk in a patient since nutritional status and body composition affects both catheter use and recovery of the infected patient (Saint et al., 2016).Knowledge of BMI distribution is relevant to catheter-associated UTI prevention in the sense that nutritional status and body composition is an additional factor that predisposes patients and compromises the ability of a patient to recover following catheter use. These results underscore the importance of risk assessment at an individual level and support the importance of early catheter removal measures.

Table 5: Independent t-test among the demographic factors in control group patients.

	t	df	Sig. (2-tailed)	Mean Difference
Age	33.770	199	.000	2.030
Gender	42.763	199	.000	1.515
Marital status	38.532	199	.000	1.543
Education	29.887	199	.000	3.115
Occupation	35.446	199	.000	2.010
Residence	44.333	199	.000	1.560
Diagnosis	33.225	199	.000	1.945
Surgery PO	32.176	199	.000	1.960
BMI	43.26	199	.000	1.928

The independent t-test results of the were summarized in Table 5 and it displays the demographic and clinical characteristics of the control group. The difference between all the variables was statistically significant with a p-value of less than 0.001 meaning that there was significant variation between the different categories measured.

The age variable t-value (t = 33.770) was high and this indicates that there was a significant difference between the age groups that formed the control population. This substantiates the broad age range in the sample as indicated before. The difference in gender (t = 42.763) was also significant that indicates the equal but differentiated percentage of males and females as mentioned above.The marital status also showed significant results (t = 38.532) and education (t = 29.887). The high mean differences show that the sample did not cluster in one of the marital groups or levels of education. Such variation can be observed in populations that are based in hospitals, and this helps to occupy the demographic variability of the control population, according to the report on CAUTI-related studies (Gould et al., 2017).The occupation and residence were also found to have statistically significant differences with t-values of 35.446 and 44.333 respectively. These results are in line with previous tables that demonstrate a general representation of urban and rural patients and diversity in terms of occupational backgrounds. These variables showed a wide range of spread of data when interpreting the risk of CAUTI since occupational activity rate and residential place may impact access to care and catheter exposure (Saint et al., 2016).Clinical variables, including diagnosis (t = 33.225), post-operative surgery category (t = 32.176), and BMI (t = 43.26), also indicated significant differences. The findings support the idea that the control group was not similar with regard to clinical characteristics. The difference in diagnoses, the types of surgeries, and the categories of BMI is also significant as they contribute to the establishment of a reliable comparison group in CAUTI research as each of these factors may be used to impact the catheter use and predisposition to the infection (Tenke et al., 2017).The overall results of the independent t-test demonstrate that the control group was not based on a rather small and homogenous population. This enhances the effectiveness of comparative studies on the control patients and people with CAUTI.

The research established apparent differences in the characteristics of patients which are pertinent to CAUTI risk. A majority of the patients were hospitalized due to urinary retention, urinary incontinence, or bladder management in the post-operative phase, and most of them had been subjected to prostatectomy or pelvic surgery. The BMI distribution showed that the majority of patients were overweight and normal and only minor groups were underweight and obese. All the factors were highly significant when demographic and clinical variables were analyzed with independent t-test, and the p values were found to be significantly below.001 in the control group. This implies that age, gender, marital status, education, occupation, residence, diagnosis, type of postoperative surgery and BMI were all sources of quantifiable difference in patient population. Combined, the results indicate that the demographic trends and clinical states are diverse and can potentially impact susceptibility to CAUTI, which is why specific assessment and prevention mechanisms should be considered.

CONCLUSION

The results indicate that the patient in the control group varied across the board in terms of their demographics and clinical features and all these were statistically significantly correlated when statistically tested. There was a significant variation in age, gender, marital status, education, occupation, residence, underlying diagnosis, postoperative surgery, and BMI. These trends indicate that CAUTI risk is determined by the interaction of patient factors and clinical conditions as opposed to the individual factor. The ideas about these differences can be used to help inform more targeted prevention activities, assist in better patient follow-ups, and enhance general management strategies on the individuals who need urinary catheterization.

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