

# Indwelling Urinary Catheter Placement and Removal Practices among Surgical Patients at Kigali University Teaching Hospital

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## Abstract

### Background

Indwelling urinary Catheters (IUCs) are routinely used medical devices among patients undergoing surgery and their undue use is a risk factor for urinary tract infections (UTIs). The study aim was to assess IUCs placement and removal practices among patients undergoing surgery.

### Methods

We carried out a cross-sectional study on 207 patients operated at Kigali University Teaching Hospital (KUTH). A pretested observation checklist (Cronbach:  $\alpha=0.851$ ) was used for data collection. The data were analyzed using SPSS version 20. Chi-square test was used to determine the association between patients' characteristics and IUCs placement and removal.

### Results

The IUC placement rate was 56.5% (n=117). There was significant association of IUCs use with gender, age, type and urgency of surgical procedures performed and the type of anesthesia used. Appropriate indication for IUC placement was established in 95.7% patients (n=112). Although 99.1% (n=116) patients were discharged from theatre with IUCs in situ, only 56.5% (n=66) had documented removal instructions.

### Conclusion

This study established that IUCs use is common and justified in surgery. However, lack of removal instruction was found to be a challenge. Therefore, the authors recommend patients' re-evaluation for post-surgery IUC need and its early removal where inappropriate to prevent CAUTIs and other complications.

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**Keywords:** Indwelling urinary catheter use, surgical patients, surgery

## Introduction

Urinary catheters are medical devices that are mostly used in critical care services [1] including operating theatres. About 15% to 25% of hospitalized patients, with up to 100% in the critical care unit, are exposed to urinary catheterization.[2,3] Most of the urinary catheterizations (21% to 63%) are done without proper indications or placed for appropriated indications but unnecessarily prolonged.[4]

The catheter-associated urinary tract infections (CAUTIs) are considered the most challenging healthcare-associated infections (HCAIs) worldwide.[1,5–7] IUCs placement contribute up to 40% of HCAIs,[2,7] corresponding to one million of CAUTIs each year.[4] An IUC is also contributes 80% of UTIs morbidity among hospitalized patients,[8] 48% of antimicrobial resistance[8] with a related cost of US\$676 on admission and \$2836 when complicated by bacteraemia.[4] The CAUTIs bacteria are coupled with higher antimicrobial use and resistance.[9]

Urinary catheterization is mostly done as perioperative routine care for the safety, and monitoring of the effectiveness of surgery.[5] However, CAUTIs are the third most common postoperative infections in addition to surgical site infection and bloodstream infection among operated patients.[10] IUC was also linked with other non-infectious complications like urethra trauma, discomfort and immobility.[4,11,12]

Different interventions to prevent CAUTIs have been studied for their effectiveness including the use of different types of catheters [1,13–15] like antiseptic, antibiotic, and silver coated catheters among others.[1] However, none revealed significance in reducing CAUTIs. Thus, the non-use or appropriate use of urinary catheter has been found to be effective in reducing the incidences of CAUTIs. The effective strategies to prevent CAUTIs after surgery are no placement or immediately removed catheter.[16,17] They cut down the rate of CAUTIs(17% to 65%).[18]

The Centre for Disease Control (CDC) through

the Healthcare Infection Control Practices Advisory Committee (HICPAC) provided guidelines for using appropriately an IUC to prevent and reduce the cost of CAUTIs. The main guideline is to avoid unnecessary use of a urinary catheter.[19] HICPAC issued indications for appropriate use of IUC.[20] CDC recommended perioperative IUC use in the following conditions: “(1) urologic surgery or other surgery on nearby structure of genitourinary tract, (2) predictable prolonged duration of surgery and this catheter has to be removed in PACU, (3) patients expected to receive large amount of fluids or diuretics during surgery”.[11,21] For patients with urine retention, those with sacral or perineal wounds and are incontinent and those with the need for immobilization following surgery,[21] IUC placement should be performed under medical order and in theatre. CDC recommends that an IUC placement for any inappropriate reason should be removed immediately. [21,22]

In Rwandan hospitals, the IUCs are being used among hospitalized patients including those who are undergoing surgeries. The bacteria like Klebsiella, Proteus, Citrobacter, Pseudomonas aeruginosa were predominantly isolated in patients with IUC, hospitalized in two University teaching hospitals. The associated antimicrobial resistance varied from 98.9% for amoxicillin, 90.4% for trimethoprim–sulphamethoxazole, 74.6% for nalidixic acid, 72.3% for amoxicillin-clavulanic acid, 57.4% for ciprofloxacin, 54.3% for ceftriaxone, 53.2% for nitrofurantoin to 50% for ceftazidime and other antibiotics which are commonly used medications to treat UTIs in Rwanda.[9] However, there is no study conducted about the use of IUC in Rwandan hospitals especially among perioperative patients. This motivated the researchers to carry out this study.

## Methods

The study took place at operating rooms of KUTH among patients operated between 21<sup>st</sup> March and 21<sup>st</sup> April 2017. A cross-sectional study design was used. The hospital admits patients referred from district hospitals for further evaluation, diagnosis and treatment. The hospital is located in Kigali, the capital city of Rwanda. This hospital has two operating theatres, main theatre and maternity theatre each with eight operating rooms. Both theatres operate 420 patients on average per month that constituted the study population. Patients undergo different types of surgery which may include general surgery, Gynaecology & Obstetrics, Ear Nose Throat (ENT), Ophthalmology, Neurosurgery, Plastic and reconstructive Surgery, Orthopaedics and trauma surgery, vascular surgery, Urology, Oral and Maxillo-facial surgery, paediatric surgery and sometimes thoracic surgery to exclude cardiac surgery. Major organ transplant surgery such as kidney, liver and heart was not yet available in the hospital.[23] The study recruited patients of all ages with different diagnoses, scheduled for emergency or elective surgery and whether the

IUC was inserted in theatre or in the ward for surgical purpose. Patients admitted to the operating theatre (OT) with an indwelling urinary catheter placed for other than surgical reasons were excluded from the study.

The sample size was estimated using Yamane Formula at a confidence limit of 95% and accepted margin error of 0.05. N was the estimated number of patients expected to undergo surgery in both OTs of KUTH for a period of one month that was 420 patients. The estimated sample size was 205 participants. A proportional sample was conveniently selected in both OT.

$$n = \frac{N}{1 + N(e)^2}$$

The institutional review boards of the University of Rwanda and KUTH approved the study. Individual consents were signed by patients who were meeting the conditions for signing a consent, next of kin for unconscious adult patients, parents or guardians for under 18 years old children. Fourteen to 17 years old children signed an assent form while their parents or guardians signed a consent form.

A pre-established observation checklist adopted from Catheter out project developed by Michigan University and sponsored by Agency for Healthcare Research and Quality (AHRQ) [20] was used to collect data with permission. Minor modifications were made to adapt it for local use in the perioperative period. The tool was tested for reliability on 17 patients before data collection who did not participate in the real study. The study tool was reliable at a Cronbach's  $\alpha$  of 0.851. The data were analysed using the statistical Package for Social Sciences (SPSS) software version 20. Both descriptive statistics and inferential statistics were used. Descriptive statistics were used to display data in frequencies and percentages of the characteristics of participants, and prevalence of IUC use. A Pearson chi-square test and Fisher exact test were calculated to identify the association of participants' characteristics with IUC placement and removal. The patients who were not exposed to IUC during their surgery were filtered and excluded before analysing the IUC removal rate and removal instructions.

## Results

Among the 207 patients sampled, 108 were admitted in the main theatre and 99 in the maternity theatre. The demographic characteristics of participants (Table 1) show that majority were females (58.45%) and their mean age was 34.7years (SD:  $\pm$ 17.7). The majority underwent emergent (57.5%), major (97.5%), and obstetrics & gynaecology surgeries, under general anaesthesia (58.5%) and regional anaesthesia (40.6%).

**Table 1. Demographic characteristics of participants**

Variable	Value	Frequency	Percentage
Age	<15 years	17	8.2%
	15-25 year	31	15.0%
	26-35 years	83	40.1%
	36-45 years	35	16.9%
	46-56years	13	6.3%
	56years and above	28	13.5%
Sex	Female	121	58.5%
	Male	86	41.5%
Type of Surgery performed	Urology	6	2.9%
	Obstetrics & gynaecology	65	31.4%
	Orthopaedics	34	16.4%
	Laparotomy	35	16.9%
	General	39	18.8%
	ENT	16	7.7%
	Neurology	12	5.8%
Seriousness of surgery	Minor	4	2.5%
	Major	203	97.5%
Urgency of surgery	Emergent	119	57.5%
	Elective	88	42.5%
Type of anaesthesia used	Local anaesthesia	2	1.0%
	Regional anaesthesia	84	40.6%
	General anaesthesia	121	58.5%
<b>Total</b>		<b>207</b>	<b>100%</b>

Regarding the prevalence of IUC, 117 patients out of 207 participants (56.5%) were exposed to IUC and 80.3% of them were catheterized in operating room. A Cross tabulation and calculated chi-square test helped to identify the characteristics significantly associated with IUC placement to include age (P<0.001), gender (P<0.001), type of surgery (p<0.001), Seriousness of

surgery (p<0.001), Urgency of surgery (p<0.001) and Type of anaesthesia used (P=0.002).

The IUC placement rate was as high as 78.3% in 26-35 years group participants, 71.9% in female, 93.8% in patients operated for obstetric and gynaecologic conditions, 73.1% in emergent surgeries and 70.2% in patients operated under regional anaesthesia.

**Table 2. Prevalence of IUC placement, association with IUC Placement with characteristics**

Demographic characteristics,		N	IUC Placement		Association with IUC placement		
			IUC placed n (%)	IUC not placed n (%)	X <sup>2</sup>	df	sig
Age	<15 years	17	1(0.9)	16(94.1)			
	15-25 year	31	15(48.4)	16(51.6)			
	26-35 years	83	65(78.3)	18(21.7)			
	36-45 years	35	16(45.7)	19(54.3)			
	46-56years	13	6(46.2)	7(53.8)			
	56years and above	28	14(50)	14(50)	<b>37.329</b>	<b>5</b>	<b>&lt;0.001</b>
Sex	Female	121	87(71.9)	34(28.1)			
	Male	86	30(34.9)	56(65.1)	<b>28.030</b>	<b>1</b>	<b>&lt;0.001</b>
Type of Surgery	Urology	6	4(66.7)	2(33.3)			
	Obst&Gyn	65	61(93.8)	4(6.2)			
	Laparotomy	35	30(85.7)	5(14.3)			
	Orthopedic	34	9(26.5)	25(73.5)			
	Neurosurgery	12	8(66.7)	4(33.3)			
	General	42	6(14.3)	36(85.7)			
	ENT+Maxillofacial surgery	16	0	16(100)	1.129	6	<0.001
	seriousness of surgery	Minor surgery	5	2(40)	3(60)		
Major surgery		203	116(57.1)	87(42.9)	21.215	2	<0.001
Urgency of surgery	Emergent	119	87(73.1)	32(26.9)	31.341	1	<0.001
	Elective	88	30(34.1)	58(65.9)			
Anaesthesia used	Local anesthesia	2	1(50)	1(50)			
	Regional anesthesia	84	59(70.2)	25(29.8)			
	General anesthesia	121	57(47.1)	64(52.9)	11.158	2	0.002
<b>Total</b>		<b>207</b>	<b>117(56.5)</b>	<b>90(43.5)</b>			

The study findings identified that 95.7% (n=112 out of 117) of patients with IUC in place had an appropriate indication for IUC placement (Table 3). Therefore, the majority of participants with IUC in place (56.4%, n=66) did not have a documented removal instruction from the surgeon. Only 27.4% (n=32) had within 24 hours removal instruction and 12% (n=14) had 24 hours to 48 hours removal instruction (Table 4). The

surgeons recorded IUC removal instructions in patients' files as postoperative instructions, mostly in obstetric and gynaecological surgeries (68.9%). The removal instructions were not documented in Orthopaedic, Neurologic and General surgeries (Table 4). Only one catheter in a patient who had undergone gynaecological surgery was removed immediately after surgery.

**Table 3. Indications for IUC Placement among patients undergoing surgery**

Indication of IUC	Appropriateness of indications		n
	Inappropriate indication	Appropriate indication	
Urologic surgical procedure	-	7	7
Surgery contiguous to genitourinary track	-	50	50
Emergency surgery with anticipated large fluid resuscitation	-	23	23
Prolonged duration of surgery	-	6	6
Intraoperative Urine output monitoring	-	18	18
Need for immobilization	-	6	6
Sacral or perineal wounds in incontinence	-	2	2
Fluid monitoring in non-critical patient	1	-	1
Incontinence	2	-	2
Immobility not related to trauma	2	-	2
<b>Total</b>	<b>5(4.3%)</b>	<b>112(95.7%)</b>	<b>117</b>

**Table 4. Postoperative IUC removal instructions recorded by the surgeon**

Type of Surgery performed n (%)	IUC removal instructions					N
	Removal within 24 hours	Above 24 hours to 48 hours	More than 48 hours (4)	No removal instructions (5)	Any Other (6)	
Urology surgery	0	1(25)	0	3(75)	0	4(100)
Obst & Gyn	31(50.8)	9(14.8)	0	19(31.1)	2(3.3)	61(100)
Laparotomy surgery	1(3.3)	4(13)	1(3.3)	22(73.3)	2(6.7)	30(100)
Orthopedic surgery	0	0	0	8(100)	0	8(100)
Neurologic surgery	0	0	0	8(100)	0	8(100)
General surgery	0	0	0	6(100)	0	6(100)
<b>Total</b>	<b>32 (27.4)</b>	<b>14 (11.9)</b>	<b>1 (0.9)</b>	<b>66 (56.5)</b>	<b>4 (3.4)</b>	<b>117</b>

## Discussion

Starting with demographic characteristics of the study participants (Table 1), almost three quarters (73.3%) of the respondents were 15-45 years old. This is closely similar to national demographics [24] in which 71.6% of the total population is between 15-34 years old. Most of the participants were females in child bearing age and underwent obstetrics & gynaecology surgeries (31.4%) which were dominating surgical procedures in this study. In line of the leading surgeries, (58.45%) were female whose surgery necessitated the use of urinary catheters to protect their pelvic organs.[25] Similarly, previous studies have shown the dominating number of women is surgery compared to men.[26,27] On the contrary, Walaszek[10] reported male dominance having studied neurosurgical patients only.

Besides Obstetrics & Gynecology, other procedures performed included general surgeries, laparotomy surgeries and orthopedic surgeries. Most of these surgeries were classified major and emergent according to KUTH protocol of surgical classification. Being a teaching and referral hospitals, most of the time, the hospital admits complicated patients referred from smaller health care institutions. This is in agreement with the global distribution of surgeries that estimated the higher proportion of emergent obstetric surgeries in low-income countries, Rwanda included.[28] A study in East African countries[29] showed that the scope of surgical procedures undertaken are narrow while the emergent life-saving procedures and obstetric surgeries are the most commonly performed procedures. Another study[27] added to the list of abdominal surgeries-mainly laparotomies' and orthopedic surgeries especially

of the extremities in tandem with this study. Considering the the factors that guide the choice of anesthesia[30], general anaesthesia technique and spinal anaesthesia were the most used in this study. This conformed to anesthetic practices at KUTH in addition to patients' considerations and was similar to techniques reported in the previous study.[27] In contrast, other studies[26,31] found that the majority of participants were operated under spinal anesthesia (70%), a technique that provides a reversible loss of sensation in a specific region or area [31].

This is attributed to the fact that their study was conducted among patients undergoing hip surgery and did not require patients to sleep. Similar to findings of other previous studies,[26,27] the IUC placement rate was significant associated with age, gender, type of surgical operation, seriousness and urgency of surgery and anesthesia technique used. Previously, a higher prevalence rate of IUC use has been reported in cardiac surgery.[32] Regional anesthesia has been associated with postoperative urine retention[33] hence the use of IUC postoperatively. Moreover, the study[27] found that among the patients operated in different surgical specialities, IUC was needed by 8.6% depending on their bladder capacity and 11.8% without considering individual bladder capacity.

The type, location and duration of the surgery determine the need for use or non-use of IUC. This justifies the routine use of IUC in some procedures such as obstetrics and gynaecology surgeries as well as in Laparotomies. IUCs are placed to empty bladder before pelvic surgery to prevent risks for bladder injuries and traumatizing other pelvic organs, to monitor input & out and for fluid resuscitation in prolonged surgeries. In contrast, some studies have evidenced that IUC is not required in caesarean delivery, hysterectomy and other gynecologic procedures, if the patient is haemodynamically stable. [34,35] Such patients are usually requested to void and empty bladder before surgery.

Although the duration of postoperative IUC retention and factors associated with non-immediate removal of the catheter were not explored within the scope of this study, prolonged duration of postoperative IUC was reported in previous studies to be associated with poor outcomes and complications.[34–37]. This study identified that the IUC removal instructions were not documented in 56.5% only and only 27.3% were recommended to be removed within 24 hours.

Further revelation from this study shows that only one (0.9%) catheter was removed among 107 IUCs that were judged unnecessary in both general and maternity OTs based on available evidence, CDCs recommendations [21] and clinical status of the patients. However, immediate IUC removal after the procedure is

recommended if the catheter is not required to remain in-situ in order to prevent postoperative CAUTIs and other related complications.[2,5,38,39] To prevent post-operative CAUTIs, the third most common postoperative infections,[10,37] all perioperative patients care team should know and carefully apply the principles of aseptic and sterile techniques at all times during procedures.[40]

Although CDC recommends that perioperative IUC is used for a medical reason and not for routine or convenience of care,[20,21] most studies have not ventured to assess the preoperative medical diagnosis and the duration of surgery that may guide the surgeon in deciding the use or non use of IUC perioperatively.

## Conclusion and recommendation

Indwelling urinary catheter is commonly used in surgical patients at KUTH and as a routine in some procedures such Obstetrics & Gynecology, laparotomy, urology, neurologic, emergent surgeries, surgeries performed under spinal anesthesia, females and 26-35 years old group. IUC placement was significantly associated with age, gender, type, seriousness and urgency of surgery, and type of anaesthesia used. The IUCs were placed for appropriate indications according to CDC guidelines such as surgery contiguous to genitourinary track, emergent surgery with anticipated large fluid resuscitation; intraoperative urine output monitoring and physician order was present in 61.5% of placed IUCs. The IUC removal instructions were not documented in 56.5% of patient with catheter in situ, especially patients operated in orthopedic, laparotomy, neurosurgery, and general surgeries. Only 1IUC was removed before patients left the PACU. The IUC retention and related complications after surgery were not assessed in this study. Again, additional information on the patients' conditions, duration of surgery and the specific procedure guidelines for IUC use still needs to be investigated. Therefore, the authors recommend patients' re-evaluation for post-surgery IUC need and its early removal where appropriate to prevent CAUTIs and other complications.

## Limitations

The study was conducted in one hospital, hence limiting the generalizability of the findings. The gravity of diagnosis and the time required by surgery determine the need for IUC; unfortunately, they were not assessed in the scope of this study.

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### Conflict of interest

The authors declare no conflicts of interest.

### Authors' contribution

The authors contributed in the conception of the study framework, writing the research proposal, developing and validating the study tool, conducting or guiding data collection and analysis and development of the manuscript for publication.

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