Inappropriate Use of Indwelling Urinary Catheters in Internal Medicine Patients

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ABSTRACT **Background:** Indwelling catheters are commonly used in non-intensive care internal medicine patients. They are associated with significant side effects.

Objectives: To determine the proportion of warranted indwelling catheters and factors associated with inappropriate use.

Methods: We included consecutive patients hospitalized in three internal medicine departments from 2020 to 2021. We determined the proportion of urinary catheters inserted in the emergency department that were retained inappropriately for monitoring urine outputs. The area under the curve (AUC) was used to determine the ability of the logistic regression model to predict inappropriate use of urinary catheterizations.

Results: Of 11,542 patients, 625 (5.4%) were excluded because they were admitted with a permanent catheter. The urinary indwelling catheterization rate was 13.3% (1454/10,917), which was appropriate in 4.9% (n=533). Patients with an unjustified indwelling catheter had a 3.75-fold (95% confidence interval 3.2–4.4) increase of prolonged hospitalization. Approximately 13 cases of a catheter associated urinary tract infection and 9% (83/921) of those with an unjustified indwelling catheter were discharged with the catheter in place. Older age, female sex, nursing assessments of patient frailty, urinary tract diseases, congestive heart failure, respiratory tract, and infectious diseases were independently associated with inappropriate use (AUC 0.847, 95% confidence interval 0.841–0.854).

Conclusions: Indwelling urinary catheters are justified in less than 5% of non-intensive care internal medicine patients and associated with significant side effects. Efforts to reduce inappropriate catheterizations might focus on frail elderly patients with infections and those presenting with urinary tract diseases, congestive heart failure, respiratory tract, and other infectious diseases.

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KEY WORDS: indwelling catheters, internal medicine, urinary catheters, catheter associated urinary tract infections (CAUTI), rates

Urinary catheterization has risks, and its use should be limited. Instrumentation of the urinary tract is responsible for 6.1% of healthcare-associated infections reported by acute care hospitals in the United States [1]. In Israel, for example, the rates of catheter associated urinary tract infections (CAUTI) in internal medicine departments in 2020 and 2021 were 3.4 and 2.7 per 1000 catheter days, respectively [2]. Furthermore, urinary catheters are associated with longer hospital stays and an increased risk of in-hospital mortality [3,4].

There are important non-infectious complications that are five times more common than catheter-related infections [5], including urgency or bladder spasms, urine leaks, difficulty starting or stopping the stream, or burning on urination, after removal in 20% of males. In 7%, after discharge, discomfort, blood in the urine, and trauma to the skin related to catheter securement or catheter placement was frequently noted. Other common side effects include restrictions in activities of daily living and visits to the emergency department for changing catheters because of blockage [5] as well as immobility, deep vein thrombosis, skin pressure injuries, and an increased risk of delirium and falls [6]. Infrequent but significant morbidities include urethral strictures and false passages during placement [7,8].

Generally, acceptable indications for an indwelling urinary catheter include the need to measure urinary output for diagnostic or clinical purposes, alteration of blood pressure or volume requiring urine volume measurement, palliative care for terminal patients, incontinence posing a risk to the patient, and obstruction of the urinary tract distal to the bladder [9]. However, more restrictive criteria lower indwelling catheterization rates. In a previous historical comparative study in patients hospitalized in one internal medicine department in 2009, it was found

that by discussing all new urinary catheter insertions during daily chart rounds the indwelling catheterization rate decreased from 17.5% to 6.6% without adverse outcomes [10]. In patients with the catheter inserted to monitor urinary output or for urinary retention, an indwelling catheter was justified only if multiple daily measurements were needed or if patients with urinary retention had a documented decrease in renal function, ureteric dilatation, recurrent urinary tract infections, sepsis, and/or patient discomfort.

In this study, we included consecutive non-intensive care patients without a permanent urinary catheter hospitalized with acute diseases and admitted to three internal medicine departments from the emergency department, determined indwelling catheter rates, the proportion that was acceptable, and factors associated with and the negative effects of unjustified use.

PATIENTS AND METHODS

We included all non-elective patients referred to internal medicine departments from the emergency department in 2020 and 2021, after excluding patients with a permanent catheter or admitted to intensive care units. From the electronic database, we reviewed the physician's stated reason for the catheterization, chief complaints, and the first two diagnoses that were entered by the physicians in the admission and discharge summaries. The patients were divided into two groups according to whether the reason for an indwelling catheter was indicated or not. Indications included urinary retention, decubitus ulcers, macroscopic hematuria, an immobilizing fracture, recommendations by the urologist for a subsequent operation, acute renal failure, and an unstable patient, as well as where it was possible that hourly monitoring of urine outputs were justified (multisystem failure, septic shock or non-septic shock, or after cardiopulmonary resuscitation). For patients who were not unstable, we assumed that there were other ways of inserting a urinary catheter to assess the patient's daily fluid output, for example in patients with congestive heart failure. The outcome variable was urinary catheters, introduced and not removed in the emergency department or on the same day of admission, catheters not removed before discharge, estimated cases of CAUTI [2] in those with an unjustified indwelling catheter, and prolonged hospitalizations (7 days or longer).

Predictor variables included the admission and discharge diagnosis, male sex, age, nursing staff patient admission observations, inadequate nutritional status, alertness, and basic laboratory tests grouped before modelling according to the normal reference ranges in addition to clinically significant cut-off values.

STATISTICAL ANALYSIS

We calculated the proportion of patients with an indwelling catheter and the proportion of hospitalization days with the presence of an indwelling urinary catheter. Means ± standard deviations, and proportions with 95% confidence intervals (95%CI) were used to describe the variables. Furthermore, we estimated the decrease in CAUTI cases if the number of indwelling catheter days included only those that were justified, using for comparison the rates reported for Laniado Hospital internal medicine departments in 2020 and 2021 [2].

Table 1. Inappropriate indwelling catheters

Reason	Total (N=10,917)	Kept in (n=1454)	Urinary retention	Pressure sore	Acute Renal failure	Not stable**	Not indicated
Urinary output	1450	835 (57.4%)	14	15	14	78	714
Urinary retention	496	347 (23.9%)		5	7	6	0
Fever	527	225 (15.5%)	2	2	7	10	204
Macroscopic hematuria	33	24 (1.7%)				1	0
Decubitus	12	10 (0.7%)				1	0
Fracture	4	4 (0.2%)					0
Other*	10	10 (0.7%)					3
Total	2529 (23.3%)	1454 (57.5%)					921 (63.3%)

*other = before a urological procedure (n=7), and missing (N=3)

**multisystem failure, septic shock or non-septic shock, or after cardiopulmonary resuscitation

Table 2. Univariate analysis variables associated with inappropriate indwelling urinary catheters

Variable	N	Urinary catheter, n (%)	Odds ratio	95% confidence interval
Age (years)				
< 40	920	5 (0.5)	2.63	2.35–2.94
40–59	1457	23 (1.6)		
60–79	3959	264 (6.7)		
≥ 80	4581	629 (13.7)		
Department-1	3375	385 (11.4)		
Department-2	3938	228 (5.8)	0.56*	0.48–0.65
Department-3	3604	308 (8.5)		
Female	5660	636 (11.2)	1.60	1.39–1.83
Bedfast	2533	550 (21.7)	5.99	5.21–6.89
Inadequate nutrition	3562	545 (15.3)	3.35	2.92–3.85
Not alert and oriented	1006	198 (19.7)	3.11	2.62–3.70
Selected diagnosis				
Congestive heart failure	715	81 (22.3)	1.42	1.12–1.81
Urinary tract diseases	993	225 (22.7)	3.88	3.29–4.59
Respiratory tract diseases	1951	223 (11.4)	1.53	1.30–1.79
Other infectious diseases	1348	140 (10.4)	1.30	1.08–1.58
Falls/syncope	774	8 (1.0)	0.11	0.05–0.21
Neurological diseases	980	39 (4.0)	0.43	0.31–0.59
Cardiovascular diseases	1746	110 (6.3)	0.69	0.56–0.85
Total unjustified catheters	10917	921 (8.4)		

*Department 2 compared to the other two departments

To determine the association between the independent variables and unjustified use of an indwelling catheter, we used logistic regression to determine the odds ratios with 95%CI. If the confidence intervals did not include 1.0, the associations were statistically significant at the 5% level. Variables that did not add significantly to the model were removed, reentered one at a time, and retained if they added significantly. For the final model, we calculated the 10% and 90% deciles of risk and c-statistic (area under the curve) that measures the ability of a model to rank patients from low to high risk. A model is considered fair if the c-statistic is ≥ 0.7, good if ≥ 0.8, and excellent if ≥ 0.9.

ETHICS APPROVAL

The project was approved by the local ethics committee (Laniado Hospital) on 4 June 2020, number 0034-20-LND. Informed consent was not required.

RESULTS

Of the 11,542 patients, 625 (5.4%) were excluded because they were admitted with a permanent catheter. The remaining 10,917 patients were 72 ± 19 years old, 51.8% (n=5660) were female, and the length of hospitalization was 4.3 ± 5.3 days.

In the emergency department, catheters were inserted in 23.2% (2532/10917) of the patients and retained in 13.3% (1454/10917). Most common, urinary catheters were inserted for follow-up of urinary outputs, and for urinary retention [Table 1]. However, the indwelling catheter was not justified in 63.3% (921/1454), and the appropriate rate was 4.9% (533/10917 [4.9%, 95%CI 4.5–5.3%]). Of the 44918 days of hospitalization, 24.4% had the presence of a urinary catheter (n=11440) but the justified rate of catheterization was 11.2% (n=5274).

Table 3. Univariate analysis laboratory variables associated with inappropriate indwelling urinary catheters

Variable	Units	Number	Catheter, n (%)	Odds ratio	95% confidence interval
Albumin (gm/dl)	≥ 3.5 3.0–3.4 < 3.0	8973 1305 639	545 (6.1) 239 (18.3) 137 (21.4)	2.28	2.08–2.50
Creatinine (mg/dl)	≥ 2	1292	251 (19.4)	3.56	3.07–4.14
Blood urea nitrogen (mg/dl)	< 20 20–29 ≥ 30	5469 2666 2782	192 (3.5) 219 (8.2) 510 (18.3)	3.22	2.75–3.78
Serum glucose (mg/dl)	< 150 150–199 ≥ 200	7455 1906 1556	527 (7.1) 193 (10.1) 201 (12.9)	1.41	1.29–1.53
White blood cells (10^{10} cells /L)	< 12 12–14.9 ≥ 15	7943 1378 1596	508 (6.4) 150 (10.9) 263 (16.5)	1.70	1.58–1.84
Neutrophils (%)	< 70% 70–79% 80–89% ≥ 90%	4161 3176 2731 849	172 (4.1) 230 (7.2) 363 (13.3) 156 (18.4)	1.78	1.66–1.91
Hemoglobin (g/L)	≥ 12 10–11.9 <10	6373 3076 1468	378 (5.9) 347 (11.3) 196 (13.4)	1.62	1.48–1.76
Platelets 10^{10} cells /L	≥ 150 100–149 < 100	9655 926 336	778 (8.1) 99 (10.7) 44 (13.1)	1.33	1.52–1.16
Total unjustified catheters	–	10917	921 (8.4)	–	–

Inappropriate indwelling catheters caused an estimated 13 cases of CAUTI (6166 catheter days × 2.2 cases per 1000 catheter days) [2] and the rate of prolonged hospitalizations was higher in those with inappropriate catheterizations 51.9% (478/921) compared to 13.5% (1349/9996) with an increased odds of 3.75-fold (95%CI 3.2–4.4) after adjustment for all the other independent variables. The catheter was not removed before discharge in 9% (83/921) of those with an unjustified indwelling catheter.

Inappropriate indwelling catheter use was associated with age, female sex, patient frailty by nursing assessments, acute infections [Table 2], and abnormal admission laboratory tests [Table 3]. Rates were also dependent on the patient's diagnosis group [Table 2]. They were higher in those with congestive heart failure, urinary tract diseases, respiratory tract diseases, and other infections. Multivariate logistic regression demonstrated that age, female sex, patient frailty, patient diagnosis, and abnormal laboratory admission tests were associated with inappropriate catheterizations (c-statistic 0.847 [95%CI 0.841–0.854]) [Table 4], with 1st and 10th decile risk rates of 0.1% to 34.5%. There was one medical department with lower odds of inappropriate catheterizations after adjustment for the other independent variables, possibly a residual effect from the previous interventional study [10].

DISCUSSION

The major finding of this study is that indwelling urinary catheter rates in non-intensive care patients in internal medicine departments were 13.3%, but warranted in only 4.9%, consistent with a previous study at our hospital where the appropriate indwelling catheterization rate was 2.5% [10]. Inappropriate indwelling urinary catheters occurred more frequently in elderly and frail patients, often bedridden and mentally impaired. A model that included age, female sex, reason for hospitalization, nursing assessments, and abnormal admission laboratory tests predicted those at low and high rates of an inappropriate indwelling urinary catheter. In those with inappropriate indwelling catheterizations there was a risk for a CAUTI, for a prolonged hospitalization, and for discharge with a urinary catheter in place.

The strength of this study is that the study group included all non-intensive care patients acutely admitted to the internal medicine departments after excluding those with a permanent urinary catheter. The cohort did not include elective admissions but only those admitted from the emergency department with an acute presentation not requiring intensive care. The well-defined cohort will allow comparisons with other settings and suggests that the rates

Table 4. Logistic regression independent associations with an inappropriate indwelling urinary

Predictor variables*	Odds ratio	95%CI
Department 2	0.59	0.50–0.70
Age groups	1.51	1.34–1.72
Female sex	1.60	1.37–1.88
Bedfast	2.37	2.02–2.80
Poor nutritional state	1.40	1.18–1.65
Not alert and oriented	1.48	1.21–1.81
Respiratory tract infections	1.88	1.53–2.32
Congestive heart failure	1.83	1.38–2.42
Urinary tract diseases	3.69	2.96–4.59
Other infections	1.59	1.25–2.02
Albumin	1.17	1.04–1.32
Blood urea nitrogen	1.47	1.32–1.64
Creatinine	1.86	1.52–2.29
White blood cell count	1.18	1.07–1.30
Neutrophils (%)	1.22	1.18–1.45
Platelets	1.24	1.06–1.45
1st decile N/N (%, 95%CI)	1/1092 (0.1, 0.0–0.5)	
10th decile N/N (%, 95%CI)	377/1092 (34.5, 31.7–37.4)	
c-statistic	0.847 (95%CI, 0.841–0.854)	

95%CI = 95% confidence interval
*Variables grouped as shown in Tables 2 and 3

of appropriate indwelling catheters in such patients should be much lower than previously reported. Furthermore, the physicians were required to stipulate the reason for inserting the urinary catheter, and the definition of an indwelling catheter did not include those where the catheter was removed either in the emergency department or on the same day of admission to the internal medicine department.

The major limitation of this study was that chart reviews were not conducted that might have increased or decreased the rates of inappropriate indwelling catheters. All insertions due to urinary retention were considered justified because chart review would be necessary to determine if there is a documented decrease in renal function, ureteric dilatation, recurrent urinary tract infections, sepsis, and/or patient discomfort [9,10]. There was also a need to review the charts in those with gross hematuria, where management with a Foley catheter is indicated only if there are blood clots in the urine [9].

However, for patients with indwelling catheters to determine urinary outputs, we considered those justified only if they had decubitus, acute renal failure, urinary retention. or unstable vital signs such as shock, which would justify hourly urinary output measurements. Urine volumes are generally recommended only if hourly measurements are needed to guide treatment, or if there is an indication for daily urine volumes that cannot be collected/assessed without a catheter [9]. However, that recommendation is unclear, and an indwelling catheter to assess 24 hour urinary outputs can be harmful. Jang et al. [11] retrospectively analyzed the medical records of acute heart failure patients of moderate or severe symptoms and found that those catheterized had higher rates of urinary complications, urinary tract infections, and longer hospital stays. John and colleagues [12] in a retrospective, non-inferiority cohort study found that those catheterized within 24 hours of diuretic therapy had no advantage in time to reach target weight, to discontinue intravenous diuretics, or resolve respiratory failure, but had an increased risk of a urinary tract infection. In addition, the need for palliative care was not systematically recorded. Still, that was unlikely to influence the rates significantly, since in the chart review prospective study, only 2.8% were admitted for palliative care, of whom only 3 (12.0%) decided to have an indwelling catheter after informed consent [9]. Last, despite reviewing the first two diagnoses on admission and on discharge as well as the patient's chief complaint, we might have missed a few cases that required hourly urinary output measurements, which would have been found on review of the charts.

Another limitation is that this study was a single center study, and it is unclear if the results can be extrapolated to other centers in Israel and worldwide. Previous studies of internal medicine patients have reported variable indwelling urinary catheter rates. Our rate of catheterization days per hospital days was 24.4%, consistent with reports of Israeli internal medical departments, which varied from around 15% to 35% over the 2-year period of 2020–2021 [2]. However 10%, 13%, 15.2%, and 25% was reported in Japan [13], Canada [14], Germany [15], and Portugal [16], respectively. Nevertheless, we have presented patient characteristics and admission laboratory results that will allow other centers to interpret our results and associated factors with inappropriate indwelling catheters and might suggest a standard for stable internal medicine patients outside intensive care.

CONCLUSIONS

In non-intensive care internal medicine patients, most indwelling urinary catheters are not indicated. Appropri-

ate rates are less than 5%. Efforts to reduce inappropriate catheterizations might focus on frail elderly patients and those admitted with congestive heart failure and infectious diseases. Benefits of reducing unjustified indwelling catheters include reducing the rates of CAUTI, prolonged hospitalizations, and discharge with a urinary catheter in place.

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Capsule

Cognitive behavioral therapy for youth with childhood-onset lupus

Cunningham and colleagues aimed to determine the feasibility and acceptability of the Treatment and Education Approach for Childhood-Onset Lupus (TEACH), a six-session cognitive behavioral intervention addressing depressive, fatigue, and pain symptoms, delivered remotely to individual youth with lupus by a trained interventionist. Of the 200 youth approached, 97 consented to participate (48.5% recruitment). Among 64 eligible participants, 32 were randomized to TEACH and treatment as usual (TAU) and 32 to TAU alone. Retention was high (92.2%). At post assessment, the intervention group demonstrated reductions in depressive (C_{emm} 7.88, 95% confidence interval [95%CI] 3.20–12.60; 14%) and fatigue (C_{emm} 3.91, 95%CI 0.44–7.39; 7%) symptoms but not pain (C_{emm} 0.89, 95%CI −0.06 to 1.84). This remotely delivered cognitive behavioral intervention tailored to youth with lupus was feasible and associated with reduced depressive and fatigue symptoms compared with medical TAU. Further increasing accessibility by implementing TEACH in medical settings may improve uptake and patient outcomes.

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