Success rates of patients with poor emptying on clean intermittent catheterization

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Introduction: *Clean intermittent catheterization (CIC) theoretically reduces incontinence, urinary tract infections (UTIs) and lower urinary tract symptoms (LUTS) in the face of poor emptying. It is unclear whether all patients realize these benefits or if CIC is only helpful for some.*

Materials and methods: ***A*** *retrospective review of 321 patients all of whom underwent urodynamic study prior to starting CIC for impaired emptying. Success was considered to be no incontinence, no UTIs, and no LUTS while performing CIC. Patients who did not meet these criteria or who stopped CIC for whatever reason were classified as failures.*

Results: *The mean duration of follow up was 4.3 years (± 4.4 years). Overall 51% of the cohort was classified as a success. Among those patients started on CIC to treat incontinence, recurrent UTIs or LUTS the success rate was 43%. We identified the comorbidity of diabetes mellitus, the use of anticholinergic medications, the need for a homecare nurse to perform the CIC, and a post-void residual (PVR) of < 300 cc at initial urodynamics to be independently associated with failure on CIC.*

Conclusions: *CIC resolved incontinence, recurrent UTIs, and LUTS in some but not all patients with impaired emptying. We identified characteristics associated with failure on CIC. Our study has provided some direction as to those individuals most and least likely to benefit from adopting this mode of bladder management for poor emptying.*

Key Words: clean intermittent catheterization, self-catheterization, urinary retention, neurogenic bladder, urinary tract infection

Introduction

Impaired bladder emptying is not uncommon among the elderly and in those with an existing neurological disorder and it may predispose to incontinence, urinary tract infections (UTIs), and lower urinary tract symptoms (LUTS). Treating the elevated post-void residual (PVR) may improve these symptoms of poor emptying in some patients.[1]

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Clean intermittent catheterization (CIC), in the manner proposed by Lapides et al, is the gold standard to treat impaired emptying of a neurogenic cause.[2,3] In this group, CIC is associated with a lower rate of infectious complications, stone disease, and upper tract abnormalities than indwelling catheterization.[4] Freedom from indwelling catheterization also contributes to improved independence, mobility, and self-esteem in these patients.[5]

Impaired emptying secondary to detrusor muscle failure or bladder outlet obstruction is common with advanced age.[6] It is thought that these patients are less likely to be offered CIC due to concerns regarding their ability to perform the technique.[7] Furthermore, catheterization by a third party can be distressing to the patient and burdensome on the caregivers.[8]

However, elderly patients have been shown to master the technique of CIC and should be offered it.[9]

It is unclear whether CIC is of benefit to all patients with symptoms related to impaired bladder emptying. In light of this, we conducted a large retrospective chart review of patients started on CIC for incomplete emptying. We sought to determine which patients were most likely to manage their bladders using CIC to prevent incontinence, recurrent UTIs, and LUTS. Here we present characteristics we observed to be associated with failure to benefit from CIC.

Materials and methods

The charts of 321 patients were reviewed. All patients were first assessed by an initial consultation at our center between 1995-2011. For each patient urodynamics (video and non-video) were performed to assess their bladder dysfunction. Patients were started on CIC based on their history and urodynamic findings. In particular incontinence, recurrent UTIs, and LUTS along with evidence of poor emptying on urodynamics were used to determine the need for CIC. In some cases patients had little or no urinary symptoms but had evidence of poor emptying with large PVRs or hydronephrosis and renal impairment. The mean PVR in this subset of patients was 391 cc (± 260 cc). All patients were seen in follow up at least once while they were performing CIC. The following data were recorded from the patient's medical records: age, sex, type of bladder dysfunction (neurogenic or non-neurogenic), chief complaint (incontinence, recurrent UTIs, LUTS or solely urinary retention in the absence of other symptoms), date of initiation of CIC, most recent date of follow up while performing CIC, initial PVR from urodynamic study, who performed the catheterization (patient and their family or homecare nurse), whether the patient was a diabetic, and whether they used anticholinergic medication.

CIC was performed in two distinct protocols. One group of patients was taught a standard protocol of CIC as a PVR by the same nurse at our institution. This protocol was the same for each patient other than the number of times CIC was performed per day and the type of catheter required. In this group of patients the PVR was documented each time by the patient and the record sent to the nurse every 2 weeks until a stable routine of CIC was established. In some instances, a family member or caregiver was taught CIC by our nurse if the patient was not capable of doing it. Follow up with a physician was arranged for 3 months after the initiation of CIC to reassess the patient's urinary symptoms. The second group had CIC performed by a home visiting nurse through a government funded program. Instructions for CIC teaching, in terms of the number times to be performed/day and the catheter size and type used, were given by the physician. The PVR results were sent to the physician every 2 weeks until a stable routine was established. In this group the patients were also seen and reassessed at 3 months by the physician. The number of times CIC was performed was determined by the PVR and voided volume such that the total was generally < 500 cc. Higher PVR values required increased catheterizations and lower PVR values reduced the number of catheterizations per day. Along with this fluid intake was monitored such that the total urine output was < 2500 cc per day.

Outcomes were determined after a review of the patient's chart. Patients were classified as a success if there was no incontinence, no recent UTIs, and no LUTS reported at their most recent follow up appointment while they were performing CIC. UTIs were determined by urine cultures and urinalysis and were performed only when patients were symptomatic. Routine cultures and urinalysis were not performed due to bacteruria commonly occurring in patients on CIC. In those on CIC purely due to a large residual they were considered a success if they were able to manage their bladders with CIC in the absence of symptoms or complications. Those patients who did not meet the criteria for success were classified as failures and the reason recorded (incontinence, UTIs, LUTS). Patients who gave up CIC because of other reasons (i.e. too inconvenient, painful or troublesome etc.) were also classified as failures.

Data analysis

Differences in proportions were tested for statistical significance using a Chi-squared test. This was used to compare differences in the frequency of the chief complaints between the men and women and between the populations with neurogenic and non-neurogenic bladder dysfunction.

To determine characteristics that were independently associated with failure to succeed with CIC we performed a multivariable logistic regression. Seven variables were included: the chief complaint, age, sex, the initial PVR at urodynamic study, the presence of diabetes mellitus, the use of anticholinergic medications, and the requirement for a homecare nurse to perform the catheterizations. The chief complaint was included as one variable with four levels (incontinence, recurrent UTIs, LUTS and asymptomatic retention). Recurrent UTIs was used as the reference group with 3 degrees of freedom. As none of the chief

complaints demonstrated a significant association with failure when controlled for the other variables it was removed and the model is presented with the remaining six variables for simplicity. Relationships were considered significant with a p value < 0.05.

Results

Patient demographics

A total of 321 patients were included in the study and their baseline characteristics are presented in Table 1. In total 45% of the patients had neurogenic bladder dysfunction and 55% had non-neurogenic bladder dysfunction. The most common etiologies for the neurogenic bladder dysfunction were: multiple sclerosis (n = 23), spina bifida (n = 21), spinal cord injury (n = 20), multi-system atrophy (n = 13), and spinal cord surgery (n = 12).

For the entire cohort started on CIC the frequency of each chief complaint is described in Table 1. We compared the frequency of each chief complaint between the men and women patients in our sample and between those with neurogenic and non-neurogenic bladder dysfunction. We observed that women with poor emptying complained more often of recurrent UTIs than men (31% versus 8% p < 0.01), Figure 1a. Men were more often observed to have asymptomatic retention than women (41% versus 19% p < 0.05), Figure 1a. No statistically significant differences were observed in the frequency of each chief complaint between those with neurogenic and non-neurogenic bladder dysfunction, Figure 1b.

TABLE 1. **Baseline characteristics**

Characteristic	**All patients n = 321**
Men/Women	153/168 (48:52%)
Mean age	57 years (± 19 years)
Neurogenic/non-neurogenic bladder dysfunction	144/177 (45:55%)
Diabetic	40 (12%)
CIC performed by a homecare nurse	56 (17%)
Coincident anticholinergic medication use	158 (49%)
Average initial PVR	300 cc (± 236 cc)
Chief complaint	
Incontinence	123 (38%)
Recurrent UTIs	64 (20%)
LUTS	39 (12%)
Asymptomatic retention	95 (30%)

CIC = clean intermittent catheterization; PVR = post-void residual; UTIs = urinary tract infections; LUTS = lower urinary tract symptoms

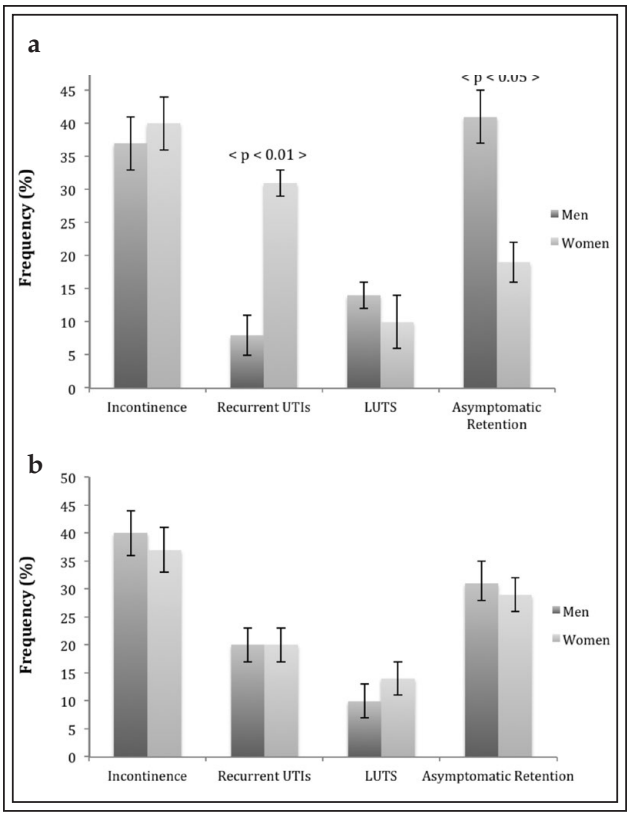

Figure 1. a) The initial chief complaint for men versus women. Data are expressed as the frequency of each chief complaint (%). Error bars denote the standard deviation. P values are included for those comparisons found to be statistically significant. **b)** The initial chief complaint for patients with neurogenic and non-neurogenic bladder dysfunction. Data are expressed as the frequency of each chief complaint (%). Error bars denote the standard deviation. No statistically significant differences were found in the comparisons.

Outcomes

The mean duration of follow up for all patients was 4.3 years (± 4.4 years). Overall 163 patients (51%) were classified as a success. Among those patients with a chief complaint of incontinence, recurrent UTIs or LUTS at initial urodynamics (excluding those patients with asymptomatic chronic retention ie. decreased renal function, hydronephrosis etc). Ninety-eight patients (43%) were classified as a success.

TABLE 2. **Patient characteristics associated with failure**

Characteristic	Unsuccessful patients/ total patients	Odds ratio for failure (95% CI)	p value
Diabetes	28/40	3.8 (1.7-8.6)	$p < 0.01$
Anticholinergic use	100/158	3.1 (1.9-5.2)	$p < 0.01$
Homecare nurse performs CIC	40/56	2.8 (1.4-5.6)	$p < 0.01$
PVR < 300 cc prior to initiating CIC	108/188	1.7 (1.0-2.8)	$p < 0.05$
Age ≥ 65	73/135	1.6 (1.0-2.7)	$p = 0.07$
Female sex	94/168	1.5 (0.9-2.5)	$p = 0.11$

CIC = clean intermittent catheterization
PVR = post-void residual

We sought to identify variables that were associated with failure to succeed with using CIC. Using a multivariable logistic regression we identified statistically significant associations with four variables: the comorbidity of diabetes mellitus, the coincident use of anticholinergic medication, having a homecare nurse perform the catheterizations, and having a PVR at initial urodynamics of < 300 cc, Table 2. The variables of patient age, sex, and the chief complaint did not meet the criteria for statistical significance. Chief complaint was dropped from the final model for simplicity and therefore is not described in Table 2, however, this did not change the statistical significance of any of the other variables described. We classified 158 patients as failures and the reasons are described in Figure 2.

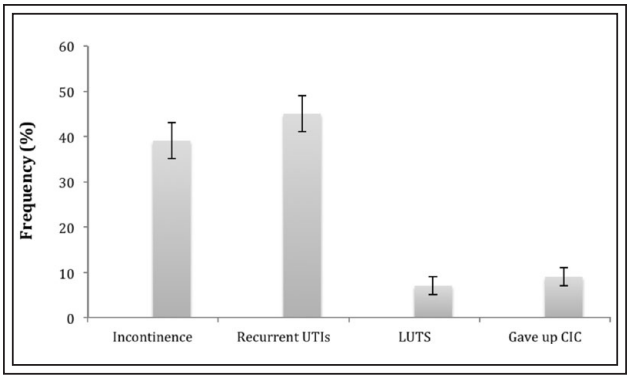

Figure 2. The most common reasons for why patients were not classified as a success. Data are expressed as the frequency of each reason for failure (%). Error bars denote the standard deviation.

Discussion

Here we show the results of 321 patients who were started on CIC to manage poor emptying. We present the frequency with which we observed CIC to be an effective treatment for symptomatic poor emptying, and also characteristics we observed to be associated with failure to benefit from CIC. Multiple studies have described the use of CIC to treat symptomatic poor emptying. CIC has been used to prevent recurrent UTIs in patients with chronic retention although results vary between the studies.[10-12] Two studies have demonstrated an improvement of incontinence with CIC.[11,13] One study showed that an improvement in LUTS was the major contributor to improved quality-of-life in patients started on CIC.[1]

We observed that roughly half of our sample was able to manage their bladder with CIC in the absence of incontinence, UTIs or LUTS. CIC did not benefit everyone and anecdotally we did observe instances where CIC worsened overall bladder symptoms. We defined success with CIC as regularly performing it in the absence of incontinence, UTIs, and LUTS. This definition implies an asymptomatic bladder and we note that this does not include patients who had improvement but not resolution of their symptoms. We chose this strict definition to eliminate some of the inherent subjectivity in judging a patient's treatment course retrospectively. Consequently, our results may underestimate the percentage of patients who will benefit in some way from CIC. Previous studies have used other criteria for defining success with CIC including the rate of discontinuation, the incidence of genitourinary complications, the incidence of UTI, the presence of incontinence, and hospitalization for a urological problem.[10,13,14]

We observed that the comorbidity of diabetes mellitus, anticholinergic medication use, having a homecare nurse perform the catheterizations, and having an initial PVR < 300 cc prior to initiating CIC were associated with failure to benefit from CIC, Table 2. Diabetes through glycosuria and altered host immune response may increase UTI predisposition independent of autonomic neuropathy and urinary retention.[15] Diabetes has previously been identified as a risk factor for UTI while performing CIC.[16] The usage of anticholinergic medications while performing CIC suggests patients with detrusor hyperactivity and impaired contractility.[17] These patients initiated CIC with a difficult bladder impairment to manage and their low success rate reflects this. We found that requiring a homecare nurse to perform the catheterizations was associated with failure. The homecare nurses in our study were only able to provide CIC a maximum of two times per day and we suspect that this frequency of catheterization is insufficient for some patients. Decreased frequency of catheterization has been reported as a risk factor UTI in a randomized study of patients performing CIC.[18,19] Furthermore, it is not always the same nurse visiting patients to perform the CIC and there is also a lack of standardization of the CIC procedure amongst them. Non-self catheterization was also identified as a risk factor for UTI in a sample of 302 patients performing CIC, but only in the men.[20] Lastly, an initial PVR < 300 cc was associated with failure. In practice PVRs < 200 cc are not uncommon and can be asymptomatic. We hypothesize that in those patients with a PVR < 300 cc who were started on CIC not all of them had symptoms attributable to poor emptying. In some of these patients their chronic poor emptying may have been coincidental and their bladder symptoms secondary to a different etiology altogether. This may explain why CIC was not beneficial in some of these patients.

Neither advanced age (≥ 65 years) or female sex were associated with failure on CIC although a non-significant trend was observed for both, Table 2. Performing CIC requires a degree of hand dexterity that may be absent in elderly patients, however, a recent study demonstrated that they are able to master the technique.[9] Previously it has been shown that the incidence of UTI when performing CIC is higher in women.[21] Women may have more difficulty localizing the external urethral meatus than men and this may predispose to accidental contamination of the catheter tip.[22] Previously women have been shown to have more difficulty than men with learning the technique of CIC.[9]

Study limitations

Due to the retrospective design of our study we were not able to use standardized symptom assessments before or after starting CIC. Hence, our assessment of the results was somewhat subjective. We also did not stratify for patients that may have been improved with CIC, and they were classified as failures if they did not meet the strict criteria for success. We did not specifically report on important complications including nephropathy, traumatic catheterization and urosepsis. As mentioned previously, the visiting home nurse was only able to do CIC at a maximum of two times per day. It is possible that more frequent catheterization may ameliorate the association between homecare nurse catheterization and failure on CIC. We considered patients as failures if they did not want to continue CIC regardless of the reason. In some instances this was due to inconvenience, discomfort or even cost. It could be argued that this is not truly a failure of CIC.

Conclusion

Here we report the success rate of a large cohort of patients who were using CIC to manage impaired emptying. Overall 51% of the cohort was classified as a success. Among those patients started on CIC to treat incontinence, recurrent UTIs or LUTS the success rate was 43%. We identified that the comorbidity of diabetes mellitus, coinciding use of anticholinergic medications, having a homecare nurse perform the catheterizations and having an initial PVR < 300 cc were associated with failure to benefit from CIC. Our study has provided some direction as to those individuals who may be less likely to benefit from CIC for the treatment of symptomatic poor emptying. □

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