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Trial Without a Catheter Programme Improves Urological Management for Retention of Urine After Hip Fracture Surgery 「沒有導尿管試驗計劃」改善髖部骨折手術後出現瀦留尿的治理



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ABSTRACT

Background: Acute retention of urine (AROU) is commonly occurred in patients with geriatric hip fractures after surgeries. It is common that the catheters cannot be weaned off after insertion.

Objectives: We compared an approach using unified Trial Without Catheter (TWOC) protocol with non-unified management plans in patients with retention of urine after hip fracture surgery, to compare these approaches in terms of (1) rate of successful catheter removal, (2) duration required for successful catheter removal, (3) number of episodes of urinary tract infection, and (4) length of hospital stay.

Methods: We conducted a retrospective cohort study of 250 patients who failed to wean off a urinary catheter. 140 out of 1349 patients between December 2012 and September 2014 formed the intervention group (treated with unified TWOC protocol), and 110 out of 1193 patients between July 2006 and December 2008 were the control group (treated with different AROU management approaches). The efficiency and effectiveness of the urological management in both groups were compared.

Results: As expected, the rate of successful TWOC was higher in intervention group (before discharge, 68.6% versus 38.2%; after discharge, 20.0% versus 18.2%, overall, 88.6% versus 56.4%). Despite trial of weaning off urinary catheters, 16 patients in intervention group and 8 patients in control group failed with permanent catheter required. Forty patients in control group were discharged with permanently catheters without a trial of TWOC.

Conclusion: The TWOC program provides structured and standardized urological management for patients suffered from AROU after geriatric hip fracture surgeries. To reiterate, indwelling urethral catheters must not be placed permanently without carrying out urological assessment in patients with geriatric hip fractures.

中文摘要

背景 留置導尿管是常用於治理老年髖部骨折併發急性尿瀦留的方法。自2012年起,我們採用了一個多學科的臨床計劃(「沒有導尿管試驗計劃」, Trial Without a Catheter - TWOC), 以規範化急性尿瀦留的治理和之後拆除導尿管的後續處理。

目標 我們從(1) 拆除導尿管的成功率, (2) 成功拆除導尿管需要的時間, (3) 尿道感染的發病率, 以及(4) 住院時間幾方面, 來比較使用與不使用TWOC計劃的果效。

方法 我們回顧性研究了250個在髖部骨折手術後無法拆除導尿管的病人。當中140個病人(出自2012年12月和2014年9月之間接受手術的1349個患者)組成實驗組(使用TWOC計劃), 另110個病人(出自2006年7月和2008年12月之間接受手術的1193個患者)組成對照組(不使用TWOC計劃)。

結果 實驗組擁有較高的拆除導尿管成功率(88.6%比56.4%, $P < 0.001$)。儘管使用TWOC計劃, 16名患者需要使用永久性的導管。在對照組中有40例在出院時使用了永久性導管, 而沒有嘗試拔除導尿管。

討論和結論 TWOC計劃規範化了老年髖部骨折併發急性尿瀦留的處理。放置永久性的導尿管前應先由泌尿外科醫生作評估。

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Introduction

Acute retention of urine (AROU) is one of the most common complications encountered during the acute and rehabilitation periods in patients suffering from geriatric hip fractures. It is usually treated by insertion of indwelling urethral catheters.^{1,2} However, previous work has failed to define a standard for bladder management in patients with geriatric hip fractures.³ The duration of keeping the catheter *in situ* and the time of accessing intervention from the urology team varies among patients in accordance

with the attending physician's judgement in our clinical setting. Sometimes, the catheters are placed permanently without an assessment by urologists. Unfortunately, AROU and the prolonged use of indwelling urethral catheters increase the risk of urinary tract infection (UTI)⁴ and stone formation.⁵ Moreover, the presence of indwelling urethral catheters increases the unwillingness of patients to return home or the reluctance of relatives to take patients home, leading to unnecessary stay in hospital.^{6,7} Therefore, placing permanent indwelling urethral catheters in affected patients without urological treatment is a concern.

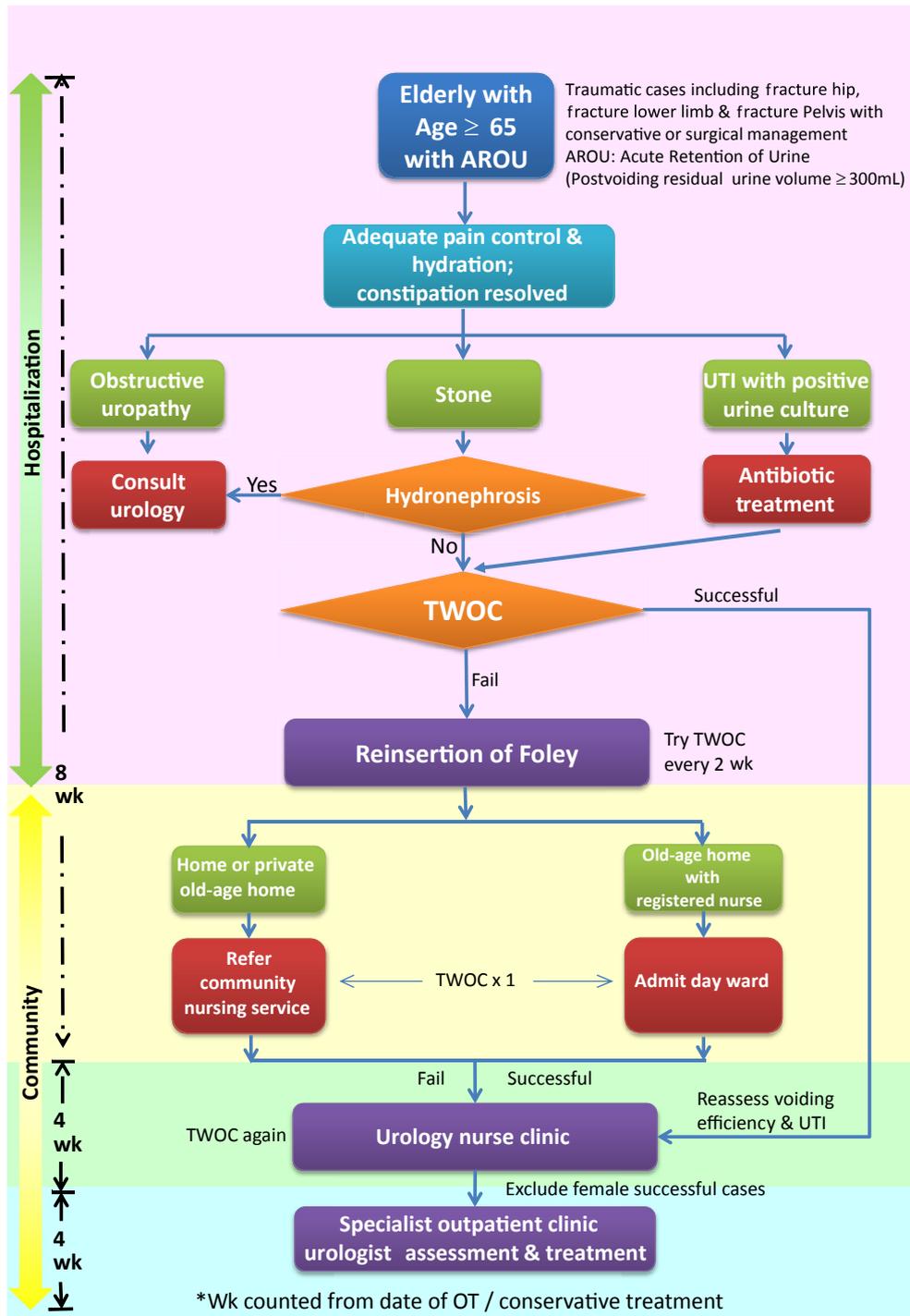


Figure 1. Trial without catheter programme model in O&T. AROU = acute retention of urine; O&T = orthopaedics and traumatology; TWOC = trial without catheter; UTI = urinary tract infection; OT = operation.

In 2011, the trial without catheter (TWOC) programme, which was a multidisciplinary urological management protocol, was implemented in our centre. The TWOC programme (Figure 1) was designed under the collaboration of urologists, orthopaedic surgeons, ward nurses, urology nurses, day ward nurses, and community nurses. The programme took care of patients throughout the acute, rehabilitation, and community phases by a multidisciplinary approach. It was initially designed to cover all eligible patients who suffered from hip fractures, lower limb fractures, and pelvic fractures with conservative or surgical intervention. Our study only focused on the patient group with geriatric hip fractures that were treated with surgery.

Methods

We retrospectively reviewed the efficiency and effectiveness of the TWOC programme with respect to the urological management outcomes of patients with hip fractures in our orthopaedic rehabilitation centre. We included 250 patients with the following criteria to the study: (1) were 65 years of age or older; (2) had femoral neck, trochanteric, or subtrochanteric fractures; (3) underwent surgery with internal fixation or arthroplasty performed under spinal or general anaesthesia; and (4) suffered from retention of urine. Patients with (1) permanent urinary catheter prior to admission, (2) active UTI, (3) obstructive uropathy, and (4) urolithiasis causing hydronephrosis were excluded from the study. Two separate urinary management approaches were implemented for these patients. We used Altman's nomogram⁸ to estimate the sample size of patients that was necessary to have 90% power to detect a 12-point difference in the catheter time between the two groups at the 5% significance level. We assumed that the standard deviation of the catheter time was ~15. We used the nomogram to estimate the required sample sizes of two groups, with $d = 12$ and $r = 15$. The standardized difference was $d/r = 12/15 = 0.80$. The line connecting a standardized difference of 0.80 and a power of 90% cut the sample size axis at ~66. Therefore, ~33 patients were required for each group.

Intervention group

From December 2012 to September 2014, we had 1349 patients who suffered from geriatric hip fractures and underwent surgery. We defined AROU when the postvoiding residual urine volume was > 300 mL. Among these patients, 140 developed AROU. The patients were managed according to a TWOC protocol. A bladder scan was performed when AROU was suspected, irrespective of the time of surgery. Bladder scan was also performed in all patients post-operatively after removal of the urinary catheter to document the residual urine volume. TWOC was considered successful if the patient was able to void and the residual urine volume was < 300 mL. Afterwards, a postvoiding bladder scan would be repeated for two more times to ascertain successful TWOC. Moreover, a bladder scan would be performed again at any moment before discharge when AROU was suspected.

The TWOC programme was developed based on the urological management guidelines.^{9–16} Once AROU was detected, the immediate treatment included the following: (1) insertion of an indwelling urethral catheter for documentation of the residual urine volume; (2) saving a urine sample for culture and sensitivity test; (3) checking renal function; and (4) performing Kidney, Ureter & Bladder (KUB) X-ray to look for urinary stones. UTIs that were confirmed by positive urine culture would be treated with antibiotics. If urinary stones were suspected, early ultrasonography of the renal system would be arranged. Urologists would be consulted directly if there was hydronephrosis or obvious renal impairment

that responded to drainage of urine, signifying the presence of obstructive uropathy.¹⁷

Prior to the trial of weaning off the urinary catheter, some prerequisite actions including pain control, constipation, and hydration management were carried out. The TWOC would be carried out according to the following schedule, counting from the date of surgery. (1) TWOC would be carried out every 2 weeks after insertion of a catheter during hospitalization. (2) When patients failed to wean off a catheter before discharge, TWOC would be carried out by a community nurse at home or at elderly homes at the eighth week after surgery. TWOC would be carried out at the surgical day ward when elderly homes were not covered by community nursing services. (3) If the TWOC in patients performed by a community nurse or a day ward nurse failed, it would be carried out by a urology nurse at the nurse clinic at twelfth week after surgery. The urology nurse would also check for patient's voiding efficiency, carry out some baseline urological investigations such as uroflowmetry before attending urology specialist clinic, and provide education to patients.

In the sixteenth week, all the male patients in whom TWOC was successful or failed would be referred to a urology specialist to rule out the possibility of prostatic or other urological pathology. Female patients would be referred only to a specialist clinic when TWOC was unsuccessful.

Control group

From July 2006 to December 2008, 1193 patients suffered from geriatric hip fractures and underwent surgery. Patients were not routinely assessed with a bladder scanner on admission. During hospitalization, AROU would be suspected according to patients' complaints, or when the nursing staff observed that patients failed to void for several hours. AROU would be confirmed by performing a urinary bladder scanning. The criteria of defining AROU varied according to individual doctor's clinical judgement, with the post-voiding residual urine volume being ≥ 500 mL. Among these patients, 110 developed AROU. Once AROU was detected, decisions regarding the insertion of a urinary catheter, the plan of weaning off the catheter, consultation with a surgeon, and a referral to a urologist clinic were made by the orthopaedic doctor in charge or the surgeon after consultation. The immediate treatment included: (1) insertion of an indwelling urethral catheter for documentation of the residual urine volume and (2) saving a urine sample for culture and sensitivity test. Symptomatic UTIs would be treated with antibiotics. Investigations for obstructive uropathy, urinary stones, and hydronephrosis were not performed.

Prior to the trial of weaning off a urinary catheter, no standardized prerequisite actions including pain control, constipation, and hydration management were carried out. The TWOC would be performed according to the following schedule: (1) during hospitalization, TWOC was carried out by ward nurses every 2 weeks during the routine change of urinary catheter; (2) when patients failed to wean off a catheter before discharge, no further TWOC would be carried out. Catheters were changed on a biweekly basis by community nurses or nursing staff in elderly homes; (3) there was no scheduled follow-up in the urology nurse clinic. TWOC would be carried out by a surgical day ward nurse for individual patients as prescribed by individual surgeons during consultation; and (4) some patients were referred to a urology specialist clinic by the orthopaedic doctor in charge or the surgeon after consultation.

Results

We performed all statistical analyses using SPSS software (version 20.0; SPSS Inc., Chicago, IL, USA). We used Chi-square tests

Table 1
Demographic and clinical characteristics of patients

Characteristics	Control group (n = 110)	Intervention group (n = 140)	p*
Age			
Mean (SD)	83.76 (7.00)	85.52 (6.92)	0.048
Median (range)	85.00 (69–98)	86.00 (66–102)	
Sex			
Male	34 (30.9)	29 (20.7)	0.078
Female	76 (69.1)	111 (79.3)	
Fracture			
Neck of femur	45 (40.9)	77 (55.0)	0.027
Trochanter	65 (59.1)	63 (45.0)	
Surgery			
Arthroplasty	36 (32.7)	63 (45.0)	
CRIF	74 (67.3)	77 (55.0)	0.052
Comorbidity			
With cerebral vascular disease	7 (6.4)	5 (3.6)	0.377
With parkinsonism	1 (0.9)	2 (1.4)	>0.99
With diabetes mellitus	14 (12.7)	28 (20.0)	0.172
With dementia	1 (0.9)	6 (4.3)	0.139
With benign prostate hypertrophy	12 (10.9)	13 (9.3)	0.677
With Ca prostate	1 (0.9)	4 (2.9)	0.388
Drugs for benign prostate hypertrophy			
On antiadrenergic agents (Doxazosin, Terazosin or Prazosin hydrochloride)	11 (10.0)	8 (5.7)	0.235
Length of stay			
Mean (SD)	39.88 (17.12)	40.96 (18.58)	0.639
Median (range)	37.00 (17–127)	39.00 (5–122)	

Data are presented as frequency (%), unless otherwise indicated.

SD = standard deviation; CRIF = closed reduction and internal fixation.

* Chi-square for proportions, *t* test for continuous variables. *p* < 0.05.

Table 2
Comparison of outcomes of trial without a catheter

Conducting a trial for removal of urinary catheter (%)	Control group (n = 110)		Intervention group (n = 140)		χ^2	<i>p</i>
	n (%)	n (%)	n (%)	n (%)		
Successful removal of urinary catheter in orthopaedic wards before discharge	42 (38.2)	96 (68.6)	23.005	<0.001 [†]		
Successful removal of urinary catheter by community nurses	0 (0.0)	19 (13.6)	—	—		
Successful removal of urinary catheter in urology nurse clinic	0 (0.0)	9 (6.4)	—	—		
Successful removal of urinary catheter in surgical day ward	20 (18.2)	0 (0.0)	—	—		
Removal tried, but failed with long-term urinary catheter	8 (7.3)	16 (11.4)	1.226	0.268		
Removal not tried with long-term urinary catheter	40 (36.4)	0 (0.0)	—	—		

* Chi-square for proportions.

[†] *p* < 0.001.

Table 3
Comparison of urinary catheter time for successful TWOC in control and intervention groups*

Catheter time (d)	Control group (n = 110)		Intervention group (n = 140)		<i>t</i>	<i>p</i>
	n (%)	Mean (SD)	n (%)	Mean (SD)		
Successful removal of urinary catheter in orthopaedic wards before discharge	42 (38.2)	31.40 (12.06)	96 (68.6)	18.55 (16.54)	4.533	<0.001 [†]
Successful removal of urinary catheter by community nurses	0 (0.0)	0 (0.0)	19 (13.6)	63.42 (10.60)	—	—
Successful removal of urinary catheter in urology nurse clinic	0 (0.0)	0 (0.0)	9 (6.4)	88.33 (18.54)	—	—
Successful removal of urinary catheter in surgical day ward	20 (18.2)	130.85 (103.73)	0 (0.0)	0 (0.0)	—	—
Total catheter time	62 (63.5)	63.48 (75.14)	124 (30.5)	30.49 (27.81)	4.340	<0.001 [†]

SD = standard deviation; TWOC = trial without catheter.

* Patients with failed TWOC were excluded.

[†] *p* < 0.001.

to compare categorical variables and independent *t* tests to compare the changes of continuous variables between groups. Statistical significance was conferred by a two-tailed *p* value of ≤ 0.05 . The groups were comparable in terms of baseline characteristics (Table 1). The rate of successful catheter removal (Table 2), duration required for successful catheter removal (Table 3), and number of episodes of UTI (Table 4) were reported. Finally, the length of hospital stay in both the intervention group and the control group was also studied.

Patients in the intervention group achieved a higher rate of successful TWOC (*p* < 0.001, Table 2). The indwelling urethral catheters were successfully removed in 96 patients (68.6%) in orthopaedic wards before they were discharged. The catheters were successfully removed in 28 more patients in the community, of which 19 (13.6%) were removed by community nurses and 9 (6.4%) in a urology nurse clinic. The overall successful rate of TWOC was 88.6%. In the control group, 42 patients (38.2%) had their catheters removed successfully before discharge, and 20 (18.2%) had their

Table 4
Comparison of urinary tract infection before removal of urinary catheter in control and intervention groups*

Episodes of urinary tract infection	Control group (n = 110)	Intervention group (n = 140)	χ^2	p
	n (%)	n (%)		
No urinary tract infection	17 (15.5)	83 (59.3)	32.151 [†]	0.001 [‡]
One episode of urinary tract infection	23 (20.9)	31 (22.1)		
More than 1 episode of urinary tract infection	22 (20.0)	10 (7.1)		

TWOC = trial without catheter.

* Patients with failed TWOC were excluded.

[†] Chi-square test.

[‡] $p < 0.001$.

catheters removed in the surgical day ward. Eight patients (7.3%) failed in TWOC and required a permanent catheter upon discharge. Forty patients (36.4%) were discharged with catheters being placed permanently without a TWOC. The overall successful rate of TWOC was 56.4%. Despite TWOC, 16 patients (11.4%) in the intervention group and 8 patients (7.3%) in the control group required permanent catheters.

Table 3 demonstrates the catheter mean time for patients with successful TWOC. With a structured and standardized protocol, the catheter time was significantly shorter in the intervention group ($p < 0.001$). The mean catheter time was 18.55 days in the hospital phase, 63.42 days in the community nursing phase, and 88.33 days in the urology nursing phase. By contrast, the mean catheter time was 31.40 days in the hospital phase and 130.85 days in the surgical day ward phase in the control group. The episodes of UTI were much lower in the intervention group ($p < 0.001$, Table 4). Moreover, the first urology specialist clinic appointment was shortened from 59 weeks to 16 weeks in the intervention group.

Discussion

AROU is not a rare complication after hip fracture.^{18–20} The reported incidence rate has been as high as 82% before surgery² and 56% after surgery.²¹ Unfortunately, it tends to be overlooked in clinical situations because it can simply be relieved by placing an indwelling urethral catheter. However, the presence of an indwelling urethral catheter may create more complications, yet the underlying urological problems are not solved. In general, the duration of keeping the indwelling urethral catheters *in situ*, frequency of trials of catheter removal, plan of further investigations, and decision regarding consultation with a urologist depend on the attending physician's judgement. Under such circumstances, it is not surprising that indwelling urethral catheters were placed permanently without urological assessment in up to one-third of the patients.

The TWOC protocol is a document with the aim of guiding decisions in managing AROU. It guides various healthcare professionals to take care of patients suffering from AROU after hip fracture surgeries from hospital to community. Trial of removal of catheter is scheduled, and in case of failure of removal before discharge, the pathway of further trials in the community and the responsible personnel are well documented. It helps reduce variation in practice, streamline the caring process, and ensure efficient utilization of resources. It contains an algorithm of risk management when obstructive uropathy is suspected. It guarantees timely input from urologists. Most important of all, follow-up appointments with a urologist was sped up to manage the urological pathology promptly. With this protocol in place, the care giver was well informed and the anxiety was greatly reduced.

Although all patients in both groups expressed that they could urinate normally before admission, no examination for voiding dysfunction was carried out before the operation. Moreover, some studies showed that spinal and opiate anaesthesia could induce

urinary retention.^{22–24} Therefore, it is important to assess patients and provide adequate opportunity for the trial of removal of the indwelling urethral catheters before the catheters are placed permanently.¹⁸ The trial of catheter removal should be allowed throughout the acute and rehabilitation phases, and should be continued in the community in case of a failure of removal of the catheter during the hospital stay. With the TWOC programme, the entire process is carried out and monitored by trained professionals. This can maximize the chance of successful catheter removal and reduce the catheter time.

In the past, there were no standard criteria to define AROU, and bladder scanning was not performed in every patient suspected to have AROU. Moreover, patients with AROU with overflow incontinence were always missed, because some healthcare workers misunderstood that “wet napkin” meant that the patient was able to void normally. Thus, the treatment and follow-up actions towards the management of AROU varied among patients. After the implementation of the TWOC programme, all geriatric hip fracture patients with AROU received standardized and timely treatment and investigations, and would have an early assessment by urology nurses and urologists if indicated. Moreover, bladder scanning was performed routinely from the time of admission and when AROU was suspected. This helped us detect AROU early, and eliminate the expressive problems in patients with advanced age or cognitive impairment who had difficulty in expressing their needs. We might have inserted more indwelling urethral catheters than before, but it was simply due to the fact that we were able to identify more patients who suffered from AROU. In fact, we were able to wean off most of the indwelling urethral catheters that were inserted when the patient was undergoing the management pathway for geriatric hip fractures. The overall rate of successful removal of indwelling urethral catheters before the patients were discharged from the hospital improved significantly from 38.2% to 68.6% ($p < 0.001$). Although a higher rate of successful catheter removal may be related to a lower insertion threshold and more chances were provided for the trial of removal, the improvement in the overall rate of successful TWOC was contributed by early detection and treatment of UTI, routine and repeated bladder scanning, additional chances for the trial of catheter removal, and increased awareness of UTI and AROU among medical and nursing staff.

The TWOC programme not only enhances the awareness of AROU among nursing staff, but also provides more chances for the trial of catheter removal. This improvement is also reflected by the significantly shorter duration of catheter time (Table 3) in the intervention group. In those patients who had the indwelling urethral catheters successfully removed before discharge from hospital, the mean catheter time was 18.55 days in the intervention group, but 31.4 days in the control group. In the past, if removal of catheters failed before discharge, the trial of removal could only be attempted during attendance to the surgical day ward, and the mean catheter time was > 4 months for those whose catheters were finally removed successfully. With the TWOC programme, the trial of catheter removal was also performed by community and urology

nurses, and altogether these services accounted for 20% of successful catheter removal. Moreover, patients were no longer being discharged without the trial of removal of the indwelling urethral catheters.

It has been reported that the risk of UTI was directly related to the duration of catheterization—estimated to be 5–10% per catheter day beyond the first 48 hours of catheterization.^{25,26} A reduction in catheter time should decrease the rate of UTI. Table 4 shows the episodes of UTI in the control and intervention groups. The overall episodes of UTI were significantly lower in the intervention group. Moreover, the number of patients who were free from UTI throughout the period with indwelling urethral catheters *in situ* was significantly higher in the intervention group.

It is not uncommon that patients and families are unwilling to go home with the presence of indwelling urethral catheters. The TWOC programme provides continuation of care to the patients by urological professionals, and we believed that it helps reduce the duration of unnecessary hospital stay. Nevertheless, the length of stay between the intervention group and the control group was similar. The mean hospital stay was around 40 days in both groups. It implies that the length of stay is affected by factors other than the presence of indwelling urethral catheters.

Limitations

We may have missed some cases of AROU in the control group since bladder scans was not routinely performed. Moreover, since urinary catheter was inserted in a higher residual urine volume in the control group, the proportion of patients who required permanent catheterization may be affected.

AROU may be due to UTI in some patients. These patients were expected to have successful TWOC after treatment of UTI. The overall rate of catheter removal may be affected. The current study could not eliminate this factor.

We changed the urethral catheter every 2 weeks because it is a common practice for those who require long-term urethral catheters. It needs further studies to determine the optimal duration of catheterization before TWOC.

Knowledge of the urological diagnosis, management, and outcome of patients who attended the urology specialist clinic may further help explain the reason of failure of TWOC in some patients, and this information may strengthen our study.

Conclusion

The TWOC programme provides structured and standardized urological management for patients suffering from AROU after geriatric hip fracture surgeries. To reiterate, indwelling urethral catheters must not be placed permanently without carrying out urological assessment in patients with geriatric hip fractures.

Conflicts of interest

The authors declare that they have no financial or nonfinancial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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