

Avoidable iatrogenic complications of urethral catheterization and inadequate intern training in a tertiary-care teaching hospital

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OBJECTIVE

To examine the magnitude of potentially avoidable iatrogenic complications of male urethral catheterization (UC) within a tertiary-care supra-regional teaching hospital, and to evaluate risk factors and subjective feeling of interns in our institution on the adequacy of training on UC.

SUBJECTS AND METHODS

Male UC-related morbidities were retrospectively identified from our computerized inpatient urology consultation system over a 1-year period from July 2006 to June 2007. Relevant medical records were also reviewed. An anonymous questionnaire

was used for the subjective assessment of interns about their training on UC. The primary outcome measures were the prevalence of urethral trauma secondary to UC by a non-urological team member in non-urological departments, risk factors and intern-perceived adequacy of practical and theoretical training on UC during their intern year, and finally the supervision of interns during first UC.

RESULTS

Of 864 urological consultations, 51 (6%) were related to complications arising from male UC during the 1-year period. The most common indication for UC was monitoring urinary output for acute medical illness (34/51, 67%). The most common complication was urethral trauma (35/51, 67%). The balloon was accidentally inflated in the urethra in six patients (12%). Of the 51 cases of UC-related morbidity, 38 (74%)

resulted from interns performing UC, and of these 28 (73%) occurred during the first 6 months of internship. Overall, 76% of interns felt that their practical training was none or inadequate; 52% (26/50) did not receive any supervision during their first UC.

CONCLUSIONS

UC-related iatrogenic morbidity is not uncommon even in a tertiary-care teaching hospital. This study identified that interns receive inadequate training on UC. Finally, most of the complications are potentially avoidable and can be prevented by adopting a proper technique of catheterization. Adequate training and supervision of medical students and interns can achieve this.

KEYWORDS

urethral catheterization, catheter morbidity, iatrogenic injury

INTRODUCTION

Urethral catheterization (UC) is a common procedure undertaken by mostly junior doctors, such as interns, even in a tertiary-care teaching hospital. In our urology department we receive frequent consultations on complications from UC; this has raised some research questions. First, what is the prevalence of iatrogenic morbidity related to the UC procedure, and secondly, whether interns receive adequate training and supervision on UC.

Apart from a few isolated case reports [1–3] there is no published study on the prevalence of iatrogenic UC-related morbidity. Also, it is unknown whether interns receive adequate training on UC. Thus the aims of the present

study were to examine the magnitude of potentially avoidable iatrogenic complications of male UC within a tertiary-care supra-regional teaching hospital, and to evaluate the risk factors and subjective feeling of interns in our institution on the adequacy of training on UC.

SUBJECTS AND METHODS

This was a retrospective study carried out in a tertiary-care supra-regional hospital between July 2006 and June 2007. The inclusion criteria for the study were: All urological inpatients consultations on complications from UC from non-urological departments; male adult patients having a first UC by a non-urological team member; the cohort of

interns who graduated (Class of 2006) from the Royal College of Surgeons in Ireland (RCSI) working in various non-urological departments in our institution. The exclusion criteria were: female patients, children (age <18 years), UC within the urology department, UC by urological team members; UC in the accident and emergency department, outpatient department and operating theatre; patients with indwelling urethral catheters that required a change of catheter.

UC-related morbidities were identified from our computerized inpatient urology consultation system over the 1-year period from July 2006 to June 2007. Relevant medical records were also reviewed to obtain detailed information of patient

Variable	Mean (range) or n (%)	TABLE 1 The demographics of the 51 patients, and the distribution of complications
Patient age, years	70.2 (21–91)	
Indication for UC		
Monitor urinary output (medical patient)	34 (67)	
Acute urinary retention after surgery	17 (33)	
Previous urological intervention (TURP)	4 (7)	
Patient on anticoagulation	3 (5)	
Clopidogrel	2	
Warfarin	1	
Complications		
Urethral trauma	35 (68)	
Gross haematuria	20 (39)	
False passage	16 (31)	
UTI/urosepsis	8 (15)	
Urethral stricture	1 (2)	
Paraphimosis	9 (17)	

demographics, indication for UC, comorbidity, medications, complications of the first UC, seniority of doctors involved in UC, further management of the complications, and urological follow-up. Based on the information presented within the referral, groups were identified for inclusion or exclusion. Those who met the inclusion criteria then had a detailed review of patient records on various outcomes. UC in the accident and emergency department, outpatient department and operating theatre were excluded because there is no computerized consultation system available from these departments. We used an anonymous questionnaire for the subjective assessment of interns on the details of their training on UC (Appendix).

The primary outcome measures were the prevalence of urethral trauma secondary to UC by a non-urological team member in non-urological departments, risk factors, intern-perceived adequacy of practical and theoretical training on UC during their intern year, and finally supervision of interns during first UC.

Secondary outcome measures included the prevalence of gross haematuria secondary to UC, magnitude of other urological complications such as UTI/urosepsis, paraphimosis and urethral stricture, the distribution of these morbidities, and the level of seniority of doctors and intern-perceived adequacy of theoretical and practical training in UC during their final medical-student year.

We also examined the type of catheter used, number of attempts at UC, time of UC (during normal office hours (08.00–17.00 h) or outside these hours while on-call, any urological intervention required, and the final outcome of any complications.

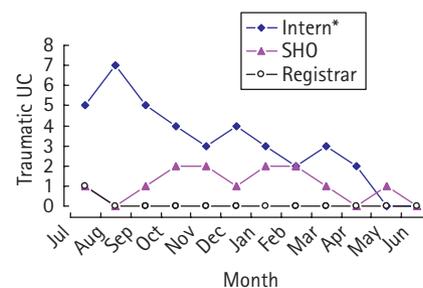
Urethral trauma was defined as discharge of frank blood via the urethra, and/or gross haematuria during UC. UTI/urosepsis was defined as pyrexia after UC and/or a positive blood culture. There is no standard universal definition of 'adequate training'. However, 'adequate training' might be defined as how well a trainee performs a procedure when not being supervised, as suggested previously [4,5]. We arbitrarily defined the adequacy of UC where interns were comfortable independently with UC procedures based on their theoretical knowledge and practical experience. Training on UC was documented as adequate or inadequate depending on the response of the intern; it was a subjective assessment. The level of training was categorized arbitrarily as none, inadequate and adequate.

The results were analysed statistically using both regression analysis and analysis of covariance (ANCOVA), with $P < 0.05$ considered to indicate statistical significance.

RESULTS

Of 864 urological consultations, 51 (6%) were related to complications from male UC during the 1-year period; the patient demographics are shown in Table 1. The most common

FIG. 1. Distribution of UC-related morbidity over 1 year from the start intern graduation (July). Intern-related morbidity was significantly higher in the first 6 months from starting clinical practice than for SHO UC-related morbidity. *Regression analysis and ANCOVA tests show a significant decreasing trend in intern UC and difference in traumatic UC compared with the SHO and Registrar group (* $P < 0.001$).



indication for UC was monitoring urinary output for acute medical illness (34/51, 67%). The distribution of complications of UC is also shown in Table 1; the most common complication was urethral trauma (35/51, 67%). The catheter balloon was accidentally inflated in the urethra in six patients (12%). Of these 35 cases, 16 (46%) showed traumatic urethral false passage on follow-up cystoscopy. Of the patients, 39% developed gross haematuria immediately after UC, lasting 2–14 days.

Of the 51 cases of UC-related morbidity, 38 (74%) resulted from interns performing UC and 12 (23%) by senior house officers (SHO), and one (2%) by a Registrar. Of these, the vast majority (27/38, 71%) occurred within the first 6 months of intern training and 76% (29/38) occurred unsupervised during on-call hours. There was a significant difference in UC morbidity caused by interns in the first 6 months after qualification (July to December) compared with more experienced SHOs. However, this trend was not apparent in the last 6 months of intern training from January to June. Figure 1 shows the distribution of UC-related morbidity over the intern training months starting in July 2006. Regression analysis showed strong evidence that on average there was a decrease in one traumatic UC per 2 months, over time ($P < 0.001$), compared with SHOs and Registrar groups, which showed no trend ($P = 0.519$). ANCOVA showed a significant difference between interns and SHO groups in UC morbidity, with a time interaction ($P < 0.001$).

Procedure	n (%)		
	None	Inadequate	Adequate
TABLE 2			
<i>Responses from the intern questionnaire</i>			
Training in UC as a medical student			
Theoretical	34 (68)	8 (16)	8 (16)
Practical	18 (36)	12 (24)	20 (40)
Training in UC during intern year			
Theoretical	0	40 (80)	10 (20)
Practical	12 (24)	32 (64)	6 (12)
Supervision during 1st UC			
	No, 26 (52)		Yes, 24 (48)

Repeated attempts at UC by the referring team failed in 12 of 51 patients. Of these, the urological registrar was successful in UC in five patients using a coude-tip catheter. The remaining seven patients required emergency insertion of a suprapubic catheter. All seven cases showed a significant iatrogenic false passage on follow-up cystoscopy and initial UC was attempted by interns during their first 6 months of medical graduation. Other morbidities secondary to traumatic first-time UC are summarized in Table 1 and include paraphimosis (17%), UTI or urosepsis (15%) and urethral stricture (1.9%).

Of 68 interns, 50 (74%) responded to the questionnaire; the distribution of responses is shown in Table 2. Overall, 88% of interns felt that their practical training was none or inadequate; 52% (26/50) received no supervision during their first UC. Surprisingly, 80% of the interns felt that they received inadequate theoretical training during their medical school and 88% felt that they received inadequate or no practical training.

DISCUSSION

There are several studies reporting the effects of chronic indwelling urinary catheters on urethral and bladder mucosa [6,7]. However, there is no published study evaluating the initial iatrogenic traumatic injury to the urethra caused by the technique of UC.

UC usually induces no or minimal microscopic haematuria [8,9]. Both the study of Sklar *et al.* [8] and Hockberger *et al.* [9] show that microscopic haematuria induced by UC rarely exceeds three red blood cells/high power field (RBC/HPF). Sklar *et al.* found that UC induced a minimal amount of haematuria (one to three RBC/HPF) in five of 15 women and 22 (69%) of 32 men undergoing urodynamic or cystometric studies in a urology clinic. This

was probably the result of urethral or bladder mucosa abrasions, and might be expected to occur more commonly in older patients with BPH and urethral stricture.

The present study differs from that of Sklar *et al.* in several important and practical respects. In that study, experienced urology personnel in urology clinics performed UC. The present study examined UC-related iatrogenic morbidity in non-urological wards by members of a non-urological team, mostly interns.

Gross haematuria after UC is an extremely uncommon event. Iatrogenic urethral trauma is more likely to occur in the presence of marked BPH or urethral stricture. However, most of the present patients had no BPH or urethral strictures. Moreover, the most common indication for UC in the present study was monitoring of urine output. Thus the most likely cause of urethral trauma is improper technique, which is due to inadequate training and supervision. Iatrogenic urethral injury can lead to bleeding, false passage, sepsis and urethral stricture, as shown in our study. Most of these complications can be prevented by adopting the proper technique of UC and catheter care.

Our study shows that a significant proportion of the urology consultations were due to iatrogenic morbidity from UC. The distribution clearly shows that inexperienced interns were responsible for most UC-related morbidity and 74% of UC insertion-related trauma occurred within the first 6 months of intern qualification. Figure 1 suggests that with increasing clinical experience UC-related morbidity within the intern group decreases throughout the year, whereas there was no such trend in the SHO group.

Even though UC is considered a common procedure, only 24% (12/50) of our interns

felt that their practical training was adequate; only 48% received supervision during their first UC (Table 2). Training and supervision in UC might be inadequate in non-teaching peripheral hospitals, possibly because of lack of adequate teaching medical personnel. However, this was a surprising finding for a tertiary-care supra-regional teaching hospital. This is the first study to highlight the magnitude of avoidable complications of UC and inadequacy of intern training on UC. Adequate training as part of the medical curriculum and senior supervision might prevent potentially avoidable complications of UC.

Cornia *et al.* [10] previously showed that there is poor documentation of UC procedures in patient charts. They found having a computerized order system increased the rate of documentation of indwelling UC, from 29% to 92%. Like many other institutions, our hospital in-patient enquiry system does not provide us with the total number of UC procedures. However, an overall idea of the number of UC can be estimated from published evidence. Jain *et al.* [11] showed that 10–25% of hospitalized patients will be catheterized during their admission. In our institution 18 000 non-urological patients were admitted between 2006 and 2007. If we assume that 10% of these patients were catheterized during that period, then ≈1800 inpatients would have UC in this period. This would in turn give a UC-related morbidity of ≈2.8%

The present study was done in a single tertiary-care supra-regional teaching hospital; this might reduce the external validity. This bias would rather reinforce our findings on potential iatrogenic morbidity and inadequate intern training even in a tertiary-care supra-regional hospital.

This was a retrospective observational study. The objective was to provide preliminary estimates of the magnitude of iatrogenic UC-related morbidity and inadequacy of training on UC. Calculations of sample sizes based on this study can be used for further studies. It is possible that a considerable proportion of UC-related morbidities were not documented, or in the event of minor complications were ignored, i.e. consultation with the urology team was not required. This would rather reinforce our findings on morbidity. A prospective assessment is likely to show more morbidity that we found in the present study.

In conclusion, the present findings have three implications for clinical practice. First, UC-related iatrogenic morbidity is not uncommon even in a tertiary-care teaching hospital. Second, this study also identified that interns receive inadequate training on UC. Finally, most of the complications are potentially avoidable and might be prevented by adopting the proper technique of UC. Adequate training and supervision of medical students and interns can achieve this.

CONFLICT OF INTEREST

None declared.

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e-mail: arunthomas75@gmail.com
- Abbreviations:** UC, urethral catheterization; SHO, Senior House Officer.

APPENDIX

Intern questionnaire survey on UC.

UC is a common procedure performed by mostly junior doctors such as interns in our hospital. In our urology department, we receive frequent consultations on complications from UC. As part of our research on morbidity of UC, we plan to examine subjective feeling of interns on their training in UC. Kindly answer the following questions:

(Please circle answers)

- 1 Did you receive formal training in urinary catheterization?
A As a 4th/Final year medical student?
Theoretical training none/minimal/adequate
Practical training none/minimal/adequate
B. As an intern?
Theoretical training none/minimal/adequate
Practical training none/minimal/adequate
2. Were you supervised when you had to place a catheter at the beginning of your intern year?
Yes/No
3. Were you confident in performing the procedure?
Yes/No

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