

PRACTICE DEVELOPMENT PAPER

Managing difficult catheterisation in nurse-led catheterisation services: Does guidewire-assisted urethral catheterisation make a difference?

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Abstract

The use of guidewires is well established in medical practice, but relatively new in nurse-led catheterisation services (NCS). We investigate the incidence of difficult urethral catheterisation and whether guidewire-assisted catheterisation reduces disrupted patient care. A retrospective Audit (September 2016-August 2017) recorded incidence and management of difficult catheterisation in two NCS. In NCS-A, nurses were familiar with improvised guidewire-assisted catheterisation, whereas in NCS-B nurses were not enabled and had to refer patients to urologists when they encountered problems. From September 2017 to August 2018, a National Institute for Health and Care Excellence (NICE)-approved urethral catheterisation device with integrated guidewire (Urethrotech UCD) was used in NCS-B for difficult urethral catheterisation. User and patient satisfaction was evaluated prospectively. Of 540 men attending NCS-A for trial without catheter (TWOC), 31% (169/540) were recatheterized, of whom 4%(6/169) required a guidewire-catheterisation technique to manage difficult catheterisation without problems. This was also done in 45 of 146 men attending for long-term catheter change with known history of difficult catheter change. Of 1002 men attending NCS-B for TWOC, 23% (226/1002) were recatheterized. This was difficult in 25% (57/226), of which 40% (23/57) suffered complications with bleeding from repeated catheterisation attempts and 10 men had to be admitted for specialist interventions to manage retention and catheterisation-associated urethral injury. During the prospective audit, 945 men attended the TWOC-clinic of NCS-B. In 11% (13/120), the UCD was used for failed Foley-catheterisation without complications. Patients and users were very satisfied because the difficult recatheterisation episode was managed successfully without patient harm and care delay. Difficult urethral catheterisation is a frequent occurrence in NCS with significant risk of urethral trauma. Catheterisation-associated urethral injury

can be prevented with guidewire-assisted urethral catheterisation techniques. The NICE-approved UCD with integrated guidewire was easy to use with high user and patient satisfaction avoiding patient care delay and is supporting nurses to manage difficult urethral catheterisation safely making efficient use of specialist resources.

KEYWORDS

catheterisation-associated urethral injury, catheterisation-associated urinary tract infection, difficult urethral catheterisation, NICE-urethral catheterisation algorithm, nurse-led catheterisation services, urethral catheterisation device

1 | BACKGROUND OF THE STUDY

In recent years, considerable amount of energy and resources have been directed towards reducing catheter-associated urinary tract infections (CAUTIs),¹ but prevention of traumatic catheterisation has not received the same attention despite contributing significantly to catheter-related morbidity. Catheterisation-related genitourinary trauma resulting in an intervention is reportedly as common or more so than symptomatic CAUTI² and 80% of injured patients experience Clavien-Dindo grade II or greater complications³ leading to additional length of hospital stay.⁴

The standardized Clavien-Dindo grading system of surgical complications is widely used to assess and report postoperative complications in many surgical specialities. Grade I describes any deviation from the normal postoperative course without the need for pharmacological treatment, or surgical, endoscopic and radiological interventions; grade II complications require pharmacological treatment including blood transfusions and total parenteral nutrition; grade III complications require surgical, endoscopic or radiological intervention; grade IV describes life-threatening complications and grade V death of a patient.

Most urology nurses are familiar with the clinical scenario of difficult or failed male urethral catheter placement with associated bleeding or pain. The male urethra is more susceptible to injury than the female urethra due to its longer length, pendulous anatomy and the presence of an enlarged prostate in elderly men. Multiple attempts at catheterisation can be stressful and traumatic for patients and health care professional alike, with the mean number of catheterisation attempts of 2.7 ± 2.7 (range: 0-20)⁵ before a referral to urology services is made, causing significant urethral injury in 32% of men and 9% had urosepsis at the time of consultation.⁵

Contemporary urological algorithms for troubleshooting difficult urethral catheterisation include using a hydrophilic nitinol guidewire to pass the catheter into the bladder according to the long-established Seldinger technique.⁶ Some nurse-led catheterisation services (NCS) incorporate guidewire-assisted urethral catheterisation-techniques into the procedural armamentarium to allow nurses to manage difficult urethral catheterisation cases independently as well, but to our awareness, no published reference literature was produced so far.

Recently, the National Institute for Health and Care Excellence (NICE) has evaluated a new Urethral Catheterisation Device (Urethrotech UCD),⁷ which is the first urinary catheter on the market to incorporate a

WHAT IS KNOWN ABOUT THE TOPIC

- Difficult male urethral catheterisation is a common problem in nurse-led catheterisation services.
- Even though guidewire-assisted urinary catheterisation is established in medical practice for many decades, it has not been widely adopted in nurse-led catheterisation services.

WHAT THIS PAPER ADDS

- This study demonstrates that nurses can safely use guidewire-assisted catheterisation to solve difficult catheterisation independently.
- Adopting a regulated purpose-designed catheterisation device with integrated guidewire to facilitate guidewire-assisted catheterisation into urological nursing practice may contribute to promoting safer catheterisation practice and avoid patient harm and patient care delay.

hydrophilic nitinol guidewire into its design to manage difficult or failed urethral catheterisation.⁸ NICE acknowledged that the UCD could be used in any health care setting by appropriately trained health care professionals who would otherwise perform urethral catheterisation.⁷

2 | OBJECTIVES

To investigate the incidence of difficult or failed urethral catheterisation in NCS and report on the clinical practice and outcomes of two different NCS to answer the question whether guidewire-assisted urethral catheterisation-techniques makes a difference managing failed catheterisation.

3 | METHODS

In agreement with the guidelines of the Helsinki Declaration as revised in 1975 and departmental approval, a retrospective audit was

FIGURE 1 Instruction for use of the Urethrotech UCD. A, Open inner sterile sleeve and inject 10 mL of sterile water to lubricate the guidewire; B, insert the guidewire into the urethra and advance with even movements into bladder; C, catheter follows guidewire into bladder; D, inflate Foley-balloon with 10 mL sterile water; E, remove guidewire; F, close off guidewire channel with plug and attach urine bag (or start bladder irrigation)

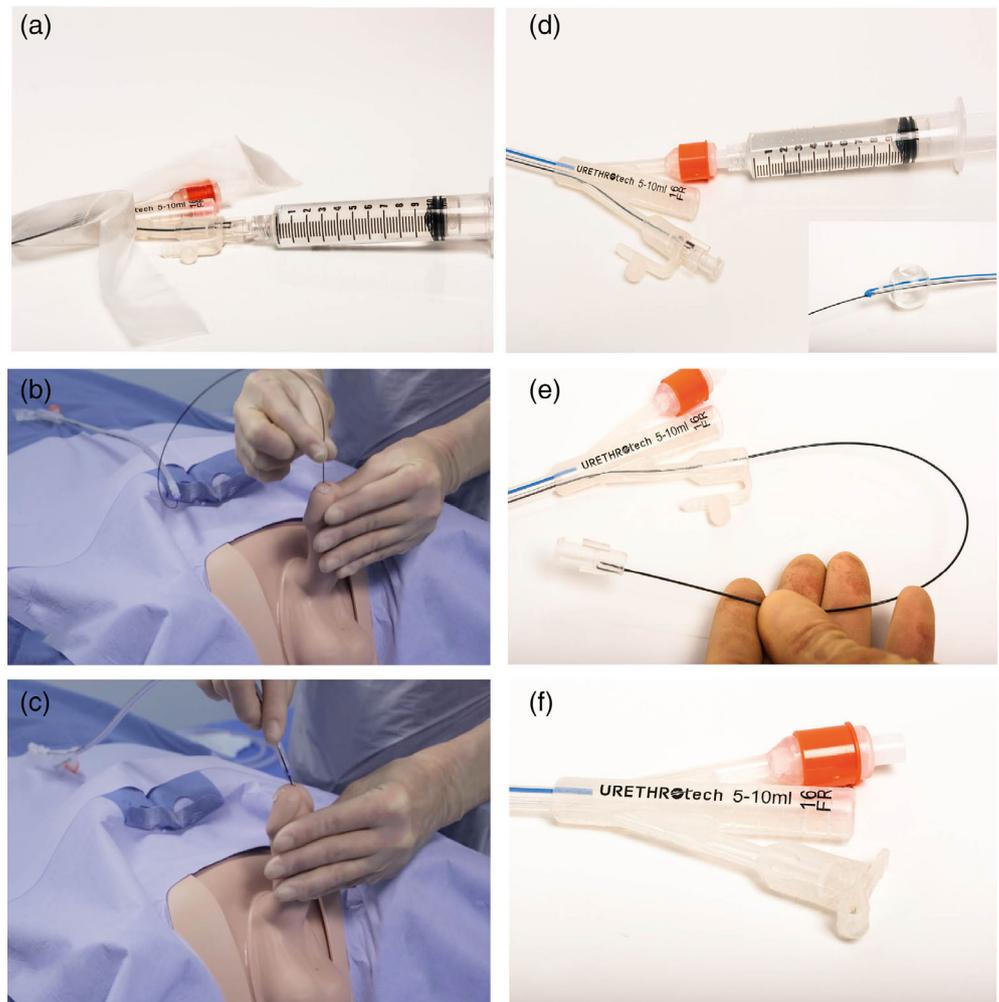
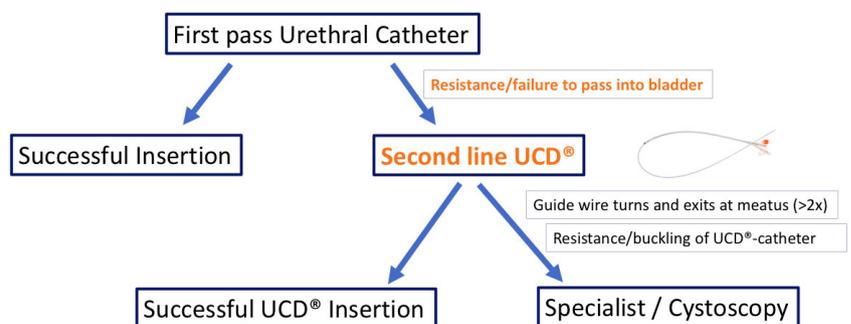


FIGURE 2 National Institute for Health and Care Excellence-approved urethral catheterisation algorithm. A simple and cost-effective algorithm to manage urethral catheterisation safely in view to prevent catheterisation-associated urethral injury (CAUI) which is suitable for any health care setting

New Male Catheterisation Algorithm



performed comparing the incidence, management and complications of difficult urethral catheterisation at two NCS of different health care settings between September 2016 and August 2017. Outreach urology nurses at NCS-A (Malta) were familiar using improvised guidewire-assisted urethral catheterisation-techniques according to published evidence⁶ to manage failed, difficult or anticipated difficult urethral catheterisation independently, whereas in NCS-B (UK), Urology trial without catheter (TWOC)-nurses were not familiar and had

to call an urologist when difficult urethral catheterisation was encountered. From September 2017 onwards, a new NICE-approved UCD with integrated guidewire (Urethrotech UCD) was available for difficult recatheterisation cases at NCS-B, and TWOC-nurses were trained to use the new device (Figure 1) according to the NICE-approved urethral catheterisation algorithm (Figure 2). A non-standardized questionnaire was used to collect user and patient feedback and to record any adverse events using the UCD.

4 | RESULTS

Of 540 men attending NCS-A for TWOC, 31% (169/540) failed their TWOC and were unable to empty the bladder and therefore had to be recatheterized. In six of those 169 men (4%), standard Foley-catheterisation was not possible and an improvised guidewire-assisted urethral catheterisation-technique was necessary to solve the difficult urethral catheterisation episode and proceed with patient care. The improvised guidewire-assisted urethral catheterisation-technique was also used in 45 of 146 men attending the NCS for long-term catheter change who had a history of difficult urethral catheterisation, and no adverse events were reported.

Of 1002 men attending NCS-B for TWOC, 23% (226/1002) had to be recatheterized for failed TWOC. This was difficult in a quarter of men (57/226): In 34 men, the Foley-catheter eventually passed after several catheterisation attempts without noticeable bleeding, but another 23 men (40%) suffered complications with bleeding from repeated attempts of which 10 men (18%) had to be referred to the urologist on-call and admitted for specialist interventions to manage retention and catheterisation-associated urethral injury (CAUI). During the prospective audit, 945 men attended the TWOC-clinic of NCS-B. There were 13 men who could not be recatheterized first pass with a standard Foley-catheter and the TWOC-nurses used the new catheterisation device with integrated guidewire (Urethrotech UCD) according to the NICE-approved urethral catheterisation algorithm (Figure 2). UCD-catheterisation was easy and successful in all 13 men and no adverse events were recorded. Patients and users were very satisfied because the difficult recatheterisation episode was solved safely and quickly without patient harm avoiding specialist referral and hospital admission.

5 | COMMENTS

Male urethral catheterisation can be challenging due to the length and tortuous anatomy of the male urethra and pathological states such as benign prostatic hyperplasia, urethral stricture and prior urological surgery. Urethral catheters are usually placed for mandatory indications and the usually straightforward procedure is most frequently performed by nurses in the United Kingdom. The Nursing profession exclusively provides Services of "Catheter Change" and "Trial-without-Catheter"—Clinics in hospitals or in the community. Yet, when catheterisation is not going to plan, Nurses are not provided with second-line equipment or devices, such as guidewires, which are in routine use for decades in the Medical profession, to enable advanced urethral catheterisation techniques. In a recent study, over 90% of difficult male urethral catheterisation cases were successfully placed by non-urologically trained doctors using guidewire-assisted urethral catheterisation according to the blind "Seldinger technique." The authors found that even in the presence of false passages or urethral stricture, the safe hydrophilic Nitinol guidewire finds its way blindly into the bladder.⁶

Paradoxically, nurses are placed into the situation that they usually have to call upon the most junior members of the medical team

with less catheterisation experience to solve the catheterisation emergency.⁹⁻¹¹

The standard Foley urinary catheter design does not address any of the common underlying reasons for difficult male urethral catheterisation, such as benign prostatic enlargement. Coudé- and Tieman-tip catheters or even metal introducers can be used to negotiate an enlarged prostate, but these techniques risk causing or exacerbating CAUI, especially if false passages are already present after failed catheterisation attempts. These techniques are particularly dangerous in patients where an unknown urethral stricture is the underlying problem, as they will undermine the stricture which can lead to urethral perforation at the stricture segment with the risk of urethral abscess formation and urinary sepsis; or, in extreme cases, even rectal injury which requires complex reconstructive surgery after often intensive care treatment to address life-threatening urinary sepsis.

Although difficult urethral catheterisation leading to CAUI occurs only in a small percentage of urethral catheterisations overall, it is an important quality and patient safety issue due to the large number of catheterisations that take place on a daily basis throughout the health care service.²

Published data on CAUI is limited probably due to the absence of specific hospital "reimbursement codes" for de-facto procedure complications and the true incidence of CAUI is difficult to establish. Most reports identify the incidence via urology consultations with an inevitable strong selection bias. Dobrowolski et al reported that of 255 anterior urethral injuries encountered in their urology referral practice 172 were due to urethral catheterisation.¹² Bacsu et al showed in their prospective observational study of urological consultation for difficult urethral catheterisation, that significant urethral injury as a result of catheterisation occurred in 32% of 89 patients accrued over a 5-month study period at two tertiary hospitals with 53% of referrals made between 5 PM and 6:30 AM.⁵ Likewise, Kashefi et al prospectively assessed the CAUI incidence among male inpatients at their institution during 6-months and identified all urethral catheter injuries from all consultation requests placed to the division of urology from any medical or surgical service for any inpatient located at any patient care area at each of two teaching hospitals and found 3.2 CAUI events per 1000 adult male hospital admissions (14 of 4310 consecutive adult male admissions).¹³ Davis et al calculated the incidence of CAUI in their prospective study at two tertiary referral teaching hospitals differently. They reported 13.4 CAUI events per 1000 catheters inserted in male patients¹⁴ and recorded the additional treatment costs of managing these 37 accrued CAUIs over the 6-month study period. The total cost of acutely managing these CAUI events was €335 337.⁴ In the long-term follow-up, 78% developed urethral strictures requiring further repeat surgical interventions for recurrent urethral stricture disease.¹⁴ Even more worryingly, 16% (6/37) of patients who suffered CAUI require ongoing care in a long-term residential facility after presenting from home because these patients were unfit for urethral stricture surgery and could not look after their palliative indwelling catheter independently due to neurodegenerative comorbidities. In another prospective study, Bugeja et al

showed that many as 9% of men undergoing cardiac surgery experience some form of adverse event related to difficult preoperative urethral catheterisation.⁸

Each case of CAUI is associated with significant short-term morbidity; 80% experience Clavien-Dindo Grade II or greater complications including life-threatening urosepsis, severe haematuria requiring blood transfusion and the need for urgent surgical intervention,⁴ and even death.¹⁴

There are two main mechanisms for CAUI during catheter insertion: (a) inadvertent inflation of the catheter anchoring balloon in the urethra when the operator did not realize that the catheter has not reached the bladder; (b) creation of a urethral false passage by applying too much force against a “stuck” catheter tip which does not advance into the bladder, which usually occurs in the bulbar or prostatic urethra.¹⁴

The most common underlying reason why a urethral catheter does not slide into the bladder is age-related prostatic enlargement, followed by undiagnosed urethral strictures⁵ or anxiety-related urethral sphincter spasm in awake patients who are unable to relax during the catheterisation procedure. In all scenarios, the operator would feel resistance as the catheter hits the anatomical or functional obstruction.

Often multiple catheterisation attempts are made, with a mean number of catheterisation attempts of 2.7 ± 2.7 (range: 0-20).⁵ The inevitable delay until specialist care is mobilized leads to the understandable motivation to try just once again; and then again when another health care professional enters the scene,⁹ thereby exposing the patient to eventual disaster with significant urethral injury in 32% of men.⁵

It is astonishing that there is no widely accepted urethral catheterisation algorithm or hospital policy available for the safe management of difficult urethral catheterisation. Recently, the NICE in the United Kingdom has evaluated a new urethral catheterisation device (Urethrotech UCD), which was purpose-designed to manage difficult urethral catheterisation. It is the first urinary catheter on the market to incorporate a guidewire into its design to provide a regulated medical device with the intended use to manage difficult catheterisation safely according to the well-established Seldinger principle¹⁵: Once the tip of the guidewire arrives at its destination, it acts as a guide that larger catheters can rapidly follow for easier delivery to the treatment site. The Urethrotech UCD features an integrated hydrophilic nitinol guidewire, which is long enough to find its way into the bladder before the catheter enters the urethra.⁸ Thanks to the non-traumatic material characteristics of the guidewire with flexible soft tip, it will negotiate any tortuous urethra deformed by prostatic enlargement, simple urethral strictures or established false passages without damaging the urothelium or bladder lining. Although the hydrophilic nitinol guidewire is soft and slippery when activated with water or normal saline, it would turn around on-itself again, were it to hit an unnegotiable obstruction or acute deep false passage. The operator would feel resistance again during guidewire advancement, which is the safest sign to abandon any blind urethral catheterisation manoeuvre. It is worth mentioning that hydrophilic nitinol guidewires are the most commonly used guidewires in medicine and surgery overall. All endovascular and coronary procedures depend on the unparalleled torque characteristics of this atraumatic guidewire material, finding its end-organ destination like no other! Should blind non-traumatic nitinol

guidewire placement fail, the patient was given nevertheless every safe and good chance that the catheterisation emergency could have been solved on the spot avoiding more invasive specialist interventions with inevitable patient care delay and likely hospital admission.

As shown in the prospective audit arm of this study, all 13 men with difficult first attempt Foley-catheterisation could be recatheterized without problems using the Urethrotech UCD: The UCD-guidewire passed smoothly into the bladder without perceivable resistance, thereby dragging the UCD-catheter automatically behind towards the external urethral meatus. From there, the UCD-catheter follows the path of the guidewire without difficulty into the bladder. Standard protocol was followed for balloon inflation, and at the end of the procedure the UCD-guidewire is removed (Figure 1).

The new catheter device was rated very highly by the TWOC-nurses of NCS-B as patients obviously benefitted from this catheter innovation. The UCD was perceived as a very welcome problem-solving tool for a frequently occurring problem. Compared to the significant incidence of CAUI during the retrospective audit period, when 40% of the men who were difficult to recatheterize with a standard Foley-catheter came to harm, and half of them had to be admitted to hospital (Table 1), it is not surprising that enthusiastic feedback was given by the TWOC-nurse and patient alike!

In this study, we have compared the clinical practice of two different NCS. In one service, urology nurses are working independently in an outreach community capacity. They were trained and professionally confident to use an improvised guidewire-assisted urethral catheterisation-technique to manage their difficult cases independently in the community. A third of men attending for “trial-without-catheter” required recatheterisation (Table 1). In most cases this was easy, but in a small percentage (4%) a guidewire-assisted urethral catheterisation-technique was necessary, but no adverse events were encountered relating to this method as illustrated by Yuminaga et al.⁶ Of the 146 patients attending NCS-A for long-term catheter change, almost a third of men were known to have difficult lower urinary tract anatomy with a previous history of difficult urethral catheterisation. Common sense dictates that in such circumstances the safer guidewire-assisted urethral catheterisation-method was utilized as the first-line choice to catheterize these men. The outreach urology nurses of NCS-A have significant experience with the Seldinger-technique and were competent to technically handle a separate guidewire and catheter without assistance. One may however not conclude from our data that this can be done equally well and reliably replicated in any health care setting where nurses are keen to advance their practice scope. Not all nurses may have the necessary professional experience to handle de-facto operating theatre equipment and sharps,—the ingredients of guidewire-assisted urethral catheterisation-techniques. One of the problems with improvised guidewire-assisted urethral catheterisation-techniques is to technically handle a long guidewire and a separate catheter. This is way more awkward outside a proper operating theatre environment, where there are no large sterile procedure drapes to cover up the entire patient, and where there is no theatre assistant available to help secure the end of the long guidewire against a safe fixed point,

TABLE 1 Results of retrospective and prospective audit

	NCS-A September 2016-August 2017 Retrospective		NCS-B September 2016-August 2017 Retrospective		NCS-B September 2017-August 2018 Prospective	
	n = 540	%	n = 1002	%	n = 945	%
TWOC-clinic patients						
Successful TWOC (patient able to empty bladder)	371		776		825	
Failed TWOC (patient unable to empty bladder)	169	31	226	23	120	13
Successful recatheterisation with standard Foley-catheter	163	96	169	75	107	89
Difficult recatheterisation with standard Foley-catheter	6	4	57	25	13	11
Improvised guidewire-assisted catheterisation technique	6		0		0	
UCD-catheterisation (integrated guidewire catheter design)	0		0		13	
CAUI (catheterisation-associated urethral injury) with bleeding	0		23	40	0	
Urology referral and Hospital admission	0		10	18	0	
Catheter change clinic patients	146		n/a		n/a	
improvised guidewire-assisted catheterisation technique	45					
CAUI (catheterisation-associated urethral injury) with bleeding	0					
Urology referral and Hospital admission	0					

Abbreviations: NCS, nurse-led catheterisation services; TWOC, trial without catheter; UCD, urethral catheterisation device.

usually along the patients leg, to avoid accidental retraction of the guidewire as the catheter is “rail-roaded” into the bladder.

Most nurse-led catheterisation clinics are run singlehandedly, and if community based, away from acute hospital care. In addition, in order to allow a standard Foley-catheter to slide over a guidewire, the tip of the catheter has to be customized. There are open ended catheters commercially available, but as they are used relatively infrequently, stock availability can become difficult to control. There are many approaches to manage difficult urethral catheterisation in the literature.¹⁰ Improvised self-made guidewire catheterisation devices have the main disadvantage that they expose the operator to significant risk of sharps-injury, let alone the risk of damaging the balloon inflation channel when the tip of the catheter is punctured with a needle or a knife leading to migration and inadvertent loss of correct position of the bladder catheter later on!

This audit demonstrates that the adoption of a simple, yet highly effective catheter innovation can significantly change the efficiency and cost-effectiveness of NCS. Once the NICE-approved innovation was available at NCS-B, patient care delay and CAUI was abolished, and the need to utilize costly specialist services would only arise if the safe second-line UCD would fail as well. This has not happened during the prospective audit period, but of course a certain failure rate would be expected as patient anatomy and clinical presentation can vary greatly in various health care settings.

At a recent urology conference, a Swiss group presented their experience with the new UCD.¹⁶ Its use was implemented as a quality and safety patient care initiative throughout the district general hospital. All relevant emergency and theatre staff were trained to use the new device to manage difficult urethral catheterisation with the aim to avoid CAUI. Over 12-months, the UCD was used in 21 men after failed standard Foley-catheterisation. In 81% of cases, this was successful,

but in 19% the catheterisation attempt failed even with the UCD and Urology referral was necessary. However, all staffs were highly satisfied with the new device and would use it again as the next step to solve difficult urethral catheterisation,¹⁶ before urology referral was necessary for more invasive methods to achieve bladder drainage.

We can confirm high user and patient satisfaction in our prospective audit as well. With the introduction of the innovative NICE-approved catheterisation device, the TWOC-Clinic of NCS-B turned round completely from a high CAUI-incidence service with 40% of men coming to harm from difficult urethral catheterisation, to an independent nurse-led practice where no patient came to harm when recatheterisation with a standard Foley-catheter was not possible. Over 1 year, the new catheter device was only needed 13 times, but when required was readily available which made all the difference to patient and nurse alike!

It is difficult to speculate why the difficult recatheterisation rate with a standard Foley-catheter was six-times higher in NCS-B than in NCS-A (Table 1), as we lack granular detail of patient cohorts regarding lower urinary tract pathology. Equally, it is difficult to speculate why over a third of difficult recatheterisations in NCS-B ended up with CAUI. It seems unlikely that operator competence is in question given the high caseload and procedural experience of HCS-B. If one was to comment with clinical insight of “real-life case scenarios,” words cannot adequately describe how stressful failed catheterisation can be for patient and operator alike. Even experienced health care providers can easily find themselves in a situation where one is trying “just once more” and “pushing just a little harder” in desperation, well aware of the potential risk of injury, but failure to catheterize the patient here and there would lead to inevitable delays until specialist services are mobilized and available.

Undoubtedly, we can show with our data that non-traumatic guidewires make a difference to patients and service providers. When it comes to managing difficult urethral catheterisation, the well-established Seldinger principle holds true for the urinary tract as well. Whether or not a regulated medical device is used for that purpose may depend on the development stage of the health care service overall. Based on our findings, guidewire-assisted catheterisation should be the next step to manage difficult urethral catheterisation in a rational and cost-effective way in the context of an effective service improvement measure to prevent CAUI before more invasive specialist services are considered or are necessary in line with the new NICE-approved urethral catheterisation algorithm (Figure 2).

6 | CONCLUSIONS AND IMPLICATIONS FOR PRACTICE

Difficult urethral catheterisation is a frequent occurrence in NCS with significant risk of urethral trauma. CAUI can be prevented with guidewire-assisted catheterisation techniques, whether or not a regulated medical device is used for that purpose. The advantage of a regulated medical device is that it is fit-for-purpose and safe for patient and operator alike. Only a purpose-developed medical device can support wide ranging NCS to manage difficult urethral catheterisation safely and help make efficient use of specialist hospital resources. The financial burden and potential medicolegal implications of CAUI are significant. Despite efforts to teach correct catheterisation technique, CAUI will continue to occur unless active steps are undertaken to provide NCS with appropriate resources to support advanced guidewire-based catheterisation techniques. The new NICE-approved urethral catheterisation algorithm is easy to integrate into existing clinical practice and enables nurses to provide safe and efficient catheterisation services.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

M.D. carried out the data analysis and interpretation of the data and drafting of the manuscript. A.B. carried out the data acquisition. K.H. carried out the data acquisition. K.A. carried out the data acquisition, A.M. supervised the study and provided critical revision and approval of the manuscript.

ETHICS STATEMENT

The audit was conducted with departmental ethics approval in agreement with the guidelines of the Helsinki Declaration as revised in 1975.

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