Complications of CISC

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Introduction

Clean intermittent self catheterisation (CISC) was first introduced and popularised by Lapides in 1972. Since then its utilisation has become widespread and it is now commonly used throughout the world as the preferred means of facilitating complete and effective bladder drainage in selected patient cohorts [1]. When performed correctly, CISC is a safe and effective technique but in common with many patient management techniques, it is often accompanied by a variety of potential, and perhaps unavoidable, complications. An understanding of these complications is vital not only for patient counselling prior to the introduction of the technique, but also for the effective prevention and management of its sequelae.

CISC is an excellent option to afford bladder emptying, both when the patient is unable to achieve any intentional voiding or when the patient voids intentionally, but incompletely, leaving a significant residual volume; it can be performed by both patient and carer alike. This article aims to review the available evidence pertaining to the potential complications of CISC.

Complications

Infection

Catheter associated urinary tract infection (CAUTI) is estimated to be the most common healthcare associated infection (HAI) in the world and the second most prevalent in England. In 2011 there was a HAI rate of 6.4% and UTIs accounted for 1.72%, almost all attributable to instrumentation of the urinary tract [2]. However, the specific rate of CAUTI secondary to CISC remains unclear. Nevertheless, it is the most common and serious complication for a patient performing CISC with an almost universal lifetime incidence in those performing the technique.

Inconsistent definitions of bacteriuria and urinary tract infection in the literature make it difficult to discern the exact incidence, prevalence and relative risk amongst the varying patient cohorts utilising this technique as a means of bladder drainage. Studies have suggested rates of approximately 2.6% per year cumulating in a five-year incidence in excess of 80% [3,4,5]. Evidence does suggest there is a benefit (in terms of UTI incidence) favouring gel reservoir and hydrophilic coated catheters – but cost is a prohibitive factor. The European Association of Urology guidelines recommend an aseptic technique as a compromise.

A recent Cochrane review on urinary catheter policies for long-term bladder drainage found that there was minimal difference in the rates of CAUTIs in patients performing CISC, regardless of whether patients were taking prophylactic antibiotics or not. This minimal but statistically significant difference was only apparent when comparing rates of afebrile UTI (incidence density relative rate 0.69), whilst no statistically significant difference was found when comparing rates of febrile UTIs [6]. Two older studies, both in paediatric populations, provide conflicting evidence, with the larger finding a higher rate of symptomatic UTIs in CISC patients who were given prophylactic antibiotics [7,8]. Another Cohrane review [9] found no benefit in the use of cranberries in juice or supplement form in preventing urinary tract infections in patients performing CISC, in contrast to those not performing CISC in whom cranberry supplementation reduces the incidence of UTI.

There are many risk factors associated with the incidence of UTI amongst patients who intermittently catheterise (Table 1), of which the most influential is thought to be technique. An excellent technique significantly reduces the risk of UTI and is one of the main indications for yearly patient consultation and technique review.

Treatment is with an appropriate antibiotic (and based according to culture, sensitivity, previous efficacious therapy and local policy).

Pyelonephritis

CISC related pyelonephritis is rare and poorly documented in the literature, with available studies suggesting a rate of 5% over six months in patients newly taught to perform CISC one to four times per 24 hours [4]. Management is with appropriate fluid and antibiotic therapy according to culture, sensitivity, previous efficacious treatment and local policy.

Urethritis

Urethritis is infrequent in the modern era as a direct consequence of improved lubrication and significantly less urethral trauma, but historical rates of between 2-19% have been reported [10-12]. It is likely that these rates have declined in recent years, with the advent of newer catheter types, materials and training programmes, etc. There is some evidence to suggest hydrophilic catheters are superior to non-coated catheters, demonstrating reduced cytological evidence of inflammation – although a direct correlation between this and urethritis has yet to be conclusively shown [13].

Epididymo-orchitis

Epididymo-orchitis is reported to occur in the region of 2.5-10% in the short term, increasing in the long term to over 40% [4,14,15]. Treatment is again with appropriate antibiotic therapy according to culture sensitivity and local policy, usually for a prolonged period of between five to six weeks.

Prostatitis

This complication is relatively common in patients performing CISC, with rates reported between 8 and 31% [16,17]. Patients typically present with perineal pain and in particular pain on catheterisation with or without a febrile

Table 1: Risk factors for UTI.	
Decreased frequency of catheterisation	Decreased frequency of catheterisation increases the time urine is stagnant in the bladder, allowing bacterial proliferation. It also leads to overfilling – stretching of the bladder wall and occlusion of capillary flow thus reducing the availability of vital immune substrates.
Increased frequency of catheterisation	Increased frequency, especially in the setting of poor technique, increases the rate at which bacteria are introduced into the bladder and thus increases the risk of UTI.
Excessive fluid intake	Increased fluid intake leads to overdistention of the bladder and decreased delivery of immune substrates, or may result in increased CISC frequency.
Decreased fluid intake	Decreased fluid intake leads to more concentrated urine and encourages a decrease in the rate of performing CISC.
Poor technique	Poor technique leads to the introduction of bacteria and increased likelihood of urethral trauma.
Pain	Pain secondary to poor technique or urethral trauma is a disincentive to continuing CISC and may result in infrequent catheterisation or complete non-compliance.
Nocturnal polyuria	Overfilling of the bladder during sleeping hours causes bladder distension, increased stagnation, inefficient voiding and decreased delivery of immune substrates.

illness. Treatment is with appropriate antibiotic therapy usually for a period of between five to six weeks, along with good hydration, adequate analgesia and on-going supportive therapy as required. Suprapubic catheterisation is often required and in very rare cases, progression to a prostatic abscess may occur requiring drainage, either transrectally or transurethrally.

Trauma

Irritation, inflammation and trauma to the urethra due to CISC are common occurrences with a long-term incidence of recurrent urethral bleeding in the region of 29%. Although much lower rates of urethritis (2-19%) have previously been quoted, many clinicians believe that some degree of urethral trauma is inevitable at some stage during a patient's CISC career [10-12,18]. Potential causes for this include poor technique and / or anatomical knowledge, lack of lubrication during insertion and catheters adhering to the urethra on removal (again secondary to inadequate lubrication). A significant number of patients will experience bleeding during the early weeks following CISC initiation.

False passage

Almost certainly under reported, false passages occur as a result of trauma, most commonly at the distal aspect of the prostate. Patients experiencing false passages often find themselves or their carers incapable of adequately catheterising due to the catheter preferentially entering the false passage. The temporary use of a wider gauge catheter may circumvent the issue as a larger catheter is less likely to enter a smaller false passage.

Table 2: Complication incidences.

Complication	Incidence	Level of evidence
Infection – UTI – Pyelonephritis – Epididymo-orchitis – Prostatitis	 2.6% per year; >80% at 5 years 5% per 6 months 40% 8-31%	 2b 3b 2b 2b
Urethral bleeding	29%	2b
Urethritis	2-19%	2b
False passage	Common in males	5
Urethral stricture	5.3% at 2.5 years; 19-21% at 7-7.5 years	2b 2b
Meatal stenosis	4% at 7 years	2b
Bladder perforation (and necrosis)	Rare	4
Catheter knotting	Rare	4
Calculi – Bladder – Renal	 15% at 17 years 2-6% at 5 years; 9% at 17 years	 2b 1b 2b

If unsuccessful, alternative means of effective bladder drainage, e.g. long-term urethral or supra-pubic catheterisation must be employed until the false passage has resolved and CISC can be recommenced.

Urethral stricture

The incidence of urethral stricture disease secondary to CISC increases with duration with prevalence rates ranging from 5% at 2.5 years to approximately 20% at 7 to 12 years [14,16,19]. Urethral stricture formation is associated with both the increased catheterisation rate and the number of years performing CISC; from this it could be inferred that risk of urethral stricture formation increases with overall number of times catheterised [16].

Meatal stenosis

Meatal stenosis secondary to CISC is a rare complication – although is a common indication for intermittent urethral dilatation. One older review article suggests a rate as high as 4% over a mean of seven years in a patient group of 75 utilising CISC for effective bladder drainage [16].
Treatment is either via continued CISC, or in more severe cases formal urethral dilatation or meatoplasty.

Bladder perforation

Bladder perforation is an exceptionally rare complication of CISC, although has been reported both in the neurogenic and the augmented bladders [20-25]. Bladder necrosis has similarly only been highlighted in case reports [20]. Treatment is with antibiotic therapy

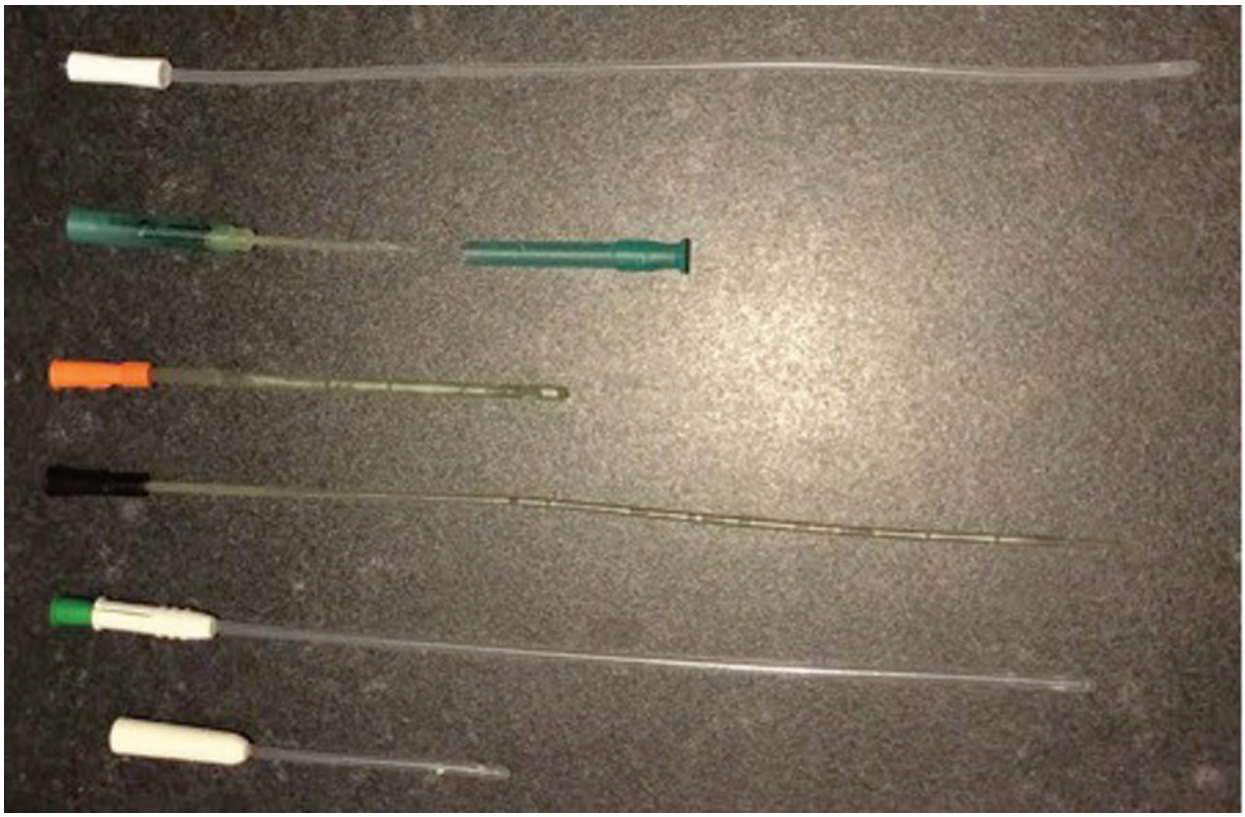

Figure 1: From top to bottom: HydroSil Gripper; SpeediCath Compact; SpeediCath Female; SpeediCath Male; LoFric Sense; LoFric Origo.

and either laparotomy and repair with a period of indwelling catheterisation for intraperitoneal rupture or drainage and indwelling catheterisation for extraperitoneal perforation.
Miscellaneous

Catheter knotting

Ball et al., Guérin et al., Brown et al. and Dogra et al. have all produced case reports on the rare complication of catheter loss into the bladder and subsequent knotting [26-29]. It is difficult to determine risk factors or frequency for this rare event.

Calculi

The incidence of bladder calculi formation in children and adults who perform CISC is higher than that of the general population. Bladder calculi are particularly well documented in adults with spinal cord injury performing CISC [30]. Ord et al. retrospectively found a bladder calculi rate of 1.5% (one patient) in their 71 patient CISC managed subset of spinal cord injury patients over a median follow-up of 81 months (giving an absolute annual risk of approximately 0.2%) [31]. More recently, rates as high as 15% over 17 years have been reported in spinal cord injury patients performing CISC [15]. The most common genesis of such bladder calculi is the introduction of pubic hair into the bladder as a consequence of retrograde catheter passage into the bladder, which then acts as a nidus for stone formation [32-34]. Renal calculi appear to be more common in patients performing CISC although the literature focuses exclusively on those patients with spinal cord injuries, thus the quoted rates of 2-6% at five years and 9% at 17 years may not be directly transferable to the entire population of patients performing CISC [15,35]. The recurrence rate in this patient group is high, with approximately 25% forming a second stone within five years [36].

Pain

Although CISC itself generally improves quality of life (QoL), in more than 60% of patients, severe chronic pain whilst performing CISC is a major predictor for a patient having a poor QoL [36]. Pain as a complication of CISC is universal initially, and may be secondary to a number of causes including: poor technique / trauma, UTI, stone disease and / or bladder spasm. When assessing pain during insertion or removal of the catheter, consideration needs to be given to failure of the pelvic floor muscles to relax, mucosal atrophy (in older women) or the patient not occluding the catheter as it is withdrawn – the subsequent vacuum sucking the bladder wall and urethra into the catheter eyelets. Fear and anxiety are important contributing factors to the pain experienced when performing CISC, both of which increase muscle contraction and hinder a patient's education (delaying improvement of technique) propagating pain. Adequate training of the patient / carer by an appropriately trained and empathic healthcare professional greatly ameliorates these factors.

Previously, there was not enough evidence to favour any particular type of catheter for CISC, although there is now a growing body of research that suggests newer hydrophilic coated catheters may reduce both rates of urinary tract infection and urethral inflammation caused by CISC and thus, it is surmised, the incidence of trauma-related sequelae. Currently, there is limited evidence favouring hydrophilic catheters with respect to, in varying degrees, urinary tract infection rates, cytological appearance of disruption to the urethra, haematuria and patient satisfaction [13,38-40].

It is important however, to note that the current evidence base has not been deemed enough by the National Institute for Health and Care Excellence (NICE) to recommend the use of the significantly more expensive hydrophilic-coated and gel reservoir catheters over their

non-coated, cheaper, alternatives. NICE guidelines were unable to make any formal recommendation with regard to the best choice of catheter, noting that of the four groups assessed (single use hydrophilic-coated, single use gel reservoir, single use non-coated and multiuse non-coated), from a cost-effectiveness analysis and quality of life standpoint, when balanced against complications (albeit with a highlighted dearth of evidence), the best option would be reusable non-coated catheters, but non-coated catheters are not licensed for multiple use, only as single use disposable item [41]. The lack of evidence precludes NICE from making an 'off-licence' recommendation.

Similarly, a recent cost-benefit analysis of CISC found that although gel reservoir and hydrophilic-coated catheters did significantly decrease the incidence of UTIs (by approximately 150 per 1000 for both), there was no difference detected in monthly or yearly UTI rates. (It is also worth noting there was no significant difference in rates detected between a clean or sterile technique for passing a non-coated catheter.) Although this suggests that hydrophilic or gel reservoir catheters are the best option, the cost is significantly higher (£2339 or £2482 per annum) than CISC (£864 per annum, using one catheter per day), but almost half that of sterile use of non-coated catheters (£4343 per annum) [42].

Conclusion

Whilst intermittent self (or carer administered) catheterisation is an excellent means of achieving effective bladder drainage, it is not without its complications, all of which must be discussed when counselling a patient prior to the introduction of the technique to the patient's management regimen. Newer catheter types, coating and lubrication may reduce the incidence of complications, but are not currently cost-effective in the current era.

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Declaration of Competing Interests
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