A new solution for indwelling catheter encrustation and blockage

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With over a million devices used in the NHS every year, indwelling urinary catheterisation is widely acknowledged as one of the most commonly used invasive healthcare procedures. Despite its widespread use, there is also extensive evidence of the risk of infection, blockage and bypassing associated with indwelling catheters, all of which can adversely affect patients’ health and quality of life, as well as placing a significant burden on the supportive health services that manage the caseloads of catheterised patients in both community and acute settings. This article looks at the reasons for the use of long-term catheters, the complications that can arise and the positive impact the use of a triclosan-based solution can have when instilled into the inflation balloon of the catheter. A selection of case studies highlight the use of Farco-fill® Protect (CliniMed) in complex patients whose only management option for effective bladder drainage is to use an indwelling catheter.

KEYWORDS:
- Continence
- Catheters
- Blockage
- Encrustation

The concept of using hollow tubes to drain the bladder has been well-documented and dates back to the time of the ancient Egyptians when bamboo and papyrus were popular catheter materials (Nazarko, 2012). Much later, the 11th century saw the development of malleable catheters, while in the 1700s these were followed by the introduction of silver catheters designed by the inventor Benjamin Franklin. Silver was identified as having antimicrobial properties useful in reducing and preventing infection. In the modern era, Frederick Foley, an American urologist, is widely credited with the introduction of the latex balloon retention catheter in 1937, a product that has changed little in design from its initial concept over 80 years ago. After World War II, Ludwig Guttmann introduced the concept of sterile intermittent catheterisation for patients with spinal cord injuries, a procedure that was popularised as clean intermittent catheterisation by Jack Lapides in the 1970s (Feneley et al, 2015).

BACKGROUND

Over one million catheters are currently used in NHS patients every year in the UK, equating to 12% of hospital patients requiring a catheter during their inpatient stay, with as many as 40% of patients in some community areas having indwelling catheters (Loveday et al, 2014). There were 281,296 hospital episodes of urinary tract infection (UTI) coded as serious adverse events in the NHS in England and Wales in 2012–2013 (Health and Social Care Information Centre [HSCIC], 2013), and the data available clearly demonstrates that indwelling urinary catheters place patients at significant risk of acquiring a catheter-associated urinary tract infection (CAUTI). In addition, the longer a catheter stays in place, the more likely the individual is to develop an infection (Loveday et al, 2014; Yard, 2015). With the current cost of treating CAUTIs estimated at close to £2,000 per episode (Loveday et al, 2014), there is a growing burden of cost on the health economy and patient quality of life.

REASONS FOR CATHETERISATION

Intermittent catheters are currently recognised as the ‘gold standard’ preferred treatment for many bladder drainage disorders such as incomplete emptying and detrusor failure (the detrusor is the smooth muscle found in the wall of the bladder). There is a group of patients, however, for whom intermittent catheterisation is not a viable treatment method. For these patients, an indwelling catheter is the only option for effective bladder drainage, despite the many associated risks.

European guidelines have acknowledged some of the reasons why an individual patient may require the use of an indwelling catheter (urethral or suprapubic) (Geng et al, 2012):

- Acute or chronic urine retention
- Certain neurological disorders affecting sensation or control of micturition
- Accurate measurements of urinary output in critically ill patients
- Perioperative use for selected surgical procedures
- Urology/genito-urinary tract surgery
- Prolonged duration of surgery and intraoperative monitoring
- To assist in healing of open sacral or perineal wounds in incontinent patients
Farco-fill® Protect is a sterile solution for inflating the catheter balloon. It contains an antimicrobial agent that can reduce encrustations, which are a common cause of catheter blockage.¹

In a 4-week clinical evaluation of Farco-fill® Protect in patients with a history of blocking, catheter wear-time was increased by an average of ten days, no catheter maintenance solutions were required and the total cost of prescriptions was reduced by 57%.²

Up to 50% of long-term catheterised patients experience catheter blockage due to encrustation.³ Help to reduce blockages with Farco-fill® Protect.

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Patients who require prolonged immobilisation (e.g., potentially unstable thoracic or lumbar spine; multiple traumatic injuries such as pelvic fractures)

- Bladder irrigation/lavage
- To maintain skin integrity in intractable incontinence
- Comfort and dignity in end-of-life care
- Acute urine output monitoring
- Detrusor failure
- Bladder irrigation following urology surgery.

**COMPLICATIONS ASSOCIATED WITH INDWELLING CATHETERS**

There are many risks associated with indwelling urinary catheters and it is commonly held that biofilms will form on the catheter material within 48 hours of insertion, increasing the risk of CAUTIs (Newman, 2007). Encrustation, pain, trauma, infection, bypassing (where draining urine seeps around the outside lumen of the catheter because the eyelets are blocked by debris, tissue or encrustation) and blockage are potential complications associated with the use of indwelling catheters (Loveday et al., 2014; Yarde, 2015).

**Infection**

Irrespective of the point of origin of the urinary catheter (urethral or suprapubic), almost all patients will develop chronic bacteriuria if the catheter remains in place for more than 30 days (Feneley et al., 2015), and chronic infection is common in long-term catheter users.

There are several reasons why infection occurs. Having a catheter in place interrupts the normal micturition cycle, which works by filling, flushing and emptying the bladder, thus washing away any harmful bacteria that otherwise may build up and cause infection.

Also, the self-retaining balloon of the catheter sits on the neck of the bladder, obstructing the urethral opening. This creates a residual volume of urine that may rise to as much as 100mls in some patients (Garcia et al., 2007). As this residual volume lies static in the base of the bladder below the drainage eyelets of the catheter, it rapidly becomes infected and colonised.

**Blockage and bypassing**

Catheter blockage and bypassing are common problems and are most likely caused by infection and encrustation, although in some cases the increased negative pressure created by a free drainage catheter system can lead to the walls of the bladder being ‘sucked’ into the drainage eyelets and preventing the flow of urine through the system (Geng et al., 2012; Feneley et al., 2015).

**Encrustation**

Encrustation forms on catheters because of a build up of urease-producing bacteria, particularly *Proteus mirabilis*. This leads to biofilm formation on the surface of the catheter, which encourages the production of magnesium phosphate and calcium crystals in the alkaline urine. These crystals attach to the catheter lumen and eyes, eventually leading to a blockage of the drainage system (Stickler et al., 2003).

Antibiotics and antiseptics have little effect on encrustation and acidic catheter maintenance solutions should be used with caution as these require breaking the catheter’s closed system every time the solution is administered, which increases the risk of infection (Davey, 2015).

Preventing or reducing the effects of encrustation on urinary catheters will help to prolong the effective life of the catheter and improve the patient experience (Stickler et al., 2003; Williams and Stickler, 2008; Sperling et al., 2014). Triclosan is a broad-spectrum antimicrobial agent that destabilises bacterial membranes by interrupting the biosynthesis of bacterial fatty acids. Studies have shown that triclosan can diffuse through the walls of the catheter balloon, leading to a significant reduction in the number of harmful bacteria including *P. mirabilis* (Pannek and Vestweber, 2011).

Triclosan has also been shown to reduce the crystallisation attached to the catheter surface, thus improving the catheter’s efficacy and extending its life (Jordan et al., 2015).

**FARCO-FILL® PROTECT**

Farco-fill Protect (CliniMed) is a sterile solution used to inflate the catheter balloon. It contains an antimicrobial agent (triclosan) that can reduce encrustation, a common cause of catheter blockage (Sperling et al., 2014) (Figures 1 and 2). The catheter is inserted into the bladder and the catheter balloon is inflated using the Farco-fill Protect prefilled syringe (instead of the sterile water or glycerol usually used to inflate the balloon). Over time, the antimicrobial in the solution diffuses through the balloon and into the bladder, reducing bacterial colonisation and helping to protect the catheter from any encrustation build-up.

In patients prone to blockages, Farco-fill Protect can extend the wear time of the catheter, thereby reducing the frequency of painful catheter changes and clinical interventions (Sperling et al., 2014; CliniMed, Data on file). In one four-week clinical evaluation of patients with a history of blocking, catheter wear time was increased by an average of ten days, no catheter maintenance solutions were required and the total cost of prescriptions was reduced by 57% (CliniMed, Data on file).

Available in prefilled syringes of 10ml, Farco-fill Protect is used in the same way as conventional catheter balloon-filling solutions, offering familiarity and peace of mind. The
amount to be instilled depends on the filling volume of the catheter balloon specified by the catheter manufacturer, but is normally between 5–10ml.

CASE STUDIES

Suprapubic catheter
Mr B is a 51-year-old man with complex health needs. He has an acquired brain injury resulting in epilepsy and a neurogenic bladder. His bladder drainage is managed with a suprapubic catheter, which has blocked frequently requiring catheter changes every few days.

When the catheter was recently removed, the community nursing team reported significant encrustation on the tip and Mr B also complained of internal pain and discomfort around the catheter tip. The specialist continence service staff tried several different types of catheter material and tips, but there was no relief from the symptoms and the catheter continued to block.

On the next catheter change, the specialist continence service staff instilled 10ml of Farco-fill® Protect into the retention balloon of an open-tip catheter. Mr B reported the catheter felt more comfortable and lasted a full two weeks before blocking. Each time the catheter was changed, the specialist continence service staff instilled Farco-fill® Protect and noticed that the episodes of blockage were less frequent. Within a couple of months Mr B was able to retain the catheter for four weeks before reporting any issues.

Having used Farco-fill® Protect for almost 18 months, Mr B is now at a stage where his catheter changes take place every four weeks and his symptoms of pain, discomfort and blockage have resolved. This particular case has demonstrated an accumulative improvement in the efficacy of the catheter since the introduction of Farco-fill® Protect, extending the life of the catheter and improving the patient experience through relief of symptoms.

Indwelling long-term urethral catheter
Mr W is a 67-year-old man with multiple sclerosis. His bladder drainage is managed with an indwelling long-term urethral catheter. The community nursing team reported many issues with encrustation, bypassing of urine and catheter blockage resulting in once-weekly catheter changes. The community nursing team had already tried a variety of catheter materials and tips, and had clarified that Mr W was eating and drinking adequately and reporting regular normal bowel movements.

The use of catheter maintenance solutions had little effect on the development of encrustation and bypassing symptoms and the time spent by the team on using catheter maintenance solutions and the increased risk of infection every time the catheter was disconnected became unacceptable.

The specialist continence service staff tried instilling Farco-fill® Protect on a recent catheter change; this catheter lasted for three weeks before a recurrence of the symptoms was reported. The specialist continence service staff continued to use Farco-fill® Protect on each catheter change and so far there appears to be an accumulative effect that extends the catheter life each time it is used. Mr W remains on a standardised programme for his catheter changes and feels his bladder management is much better controlled without the need for catheter maintenance solutions.

Long-term urethral catheter
Ms G is a 64-year-old woman with chronic obstructive pulmonary disease (COPD) and other long-term conditions affecting her mobility and general health. She has a long-term urethral catheter in place to manage her intractable incontinence.

The community nursing team reported frequent catheter blockages that did not respond to any other interventions. Catheter maintenance solutions were used every few days, increasing the patient’s risk of infection through repeated breaking of the closed drainage system. The specialist continence service staff suggested the community nursing team try Farco-fill® Protect for balloon instillation on the next catheter change. The community nursing team and the patient noticed an

Figure 1.
Farco-fill® Protect is a sterile solution used to inflate catheter balloons.

KEY POINTS

- Indwelling urinary catheters place patients at significant risk of acquiring a catheter-associated urinary tract infection (CAUTI).
- The longer a catheter stays in place, the more likely the individual is to develop an infection.
- Catheter encrustation and blockage are common problems in patients undergoing long-term catheterisation. The problem stems from urease-producing bacteria, particularly Proteus mirabilis.
- Farco-fill® Protect (CliniMed) is a sterile solution used to inflate the catheter balloon. It contains an antimicrobial agent that can help reduce catheter encrustation and blockage.
- All patients should have an individualised assessment and treatment plan when considering bladder drainage.
- The use of a product such as Farco-fill® Protect in these circumstances can lead to an improvement for all concerned and is a useful tool in the armoury of any community nurse involved with managing problematic complex catheters.
immediate improvement and she is currently on a four-week schedule of catheter changes.

The community nursing team now report little visual evidence of debris or encrustation on the catheter tips when using Farco-fill Protect. Ms G has reported an improvement in her comfort in relation to the catheter and is much happier having fewer interventions and time spent managing the blockages and washouts. To date she has not required a catheter maintenance solution since introducing the Farco-fill Protect regimen.

Discussion
All of the patients in the case histories have complex medical needs with established catheter problems lasting over several months or years. These frequent catheter blockages have been painful and distressing for the individuals and the nurses had made several unplanned visits to try to resolve problems with little improvement.

Many of the patients’ catheters were being treated with catheter maintenance solutions, often on a daily basis, increasing the risk of infection caused by breaking the closed drainage system. Several services, including the community nursing team, were called to attend out of hours, and some patients had unplanned acute hospital visits when their catheter issues could not be resolved locally. This has impacted on their quality of life and increased the workload for staff, having a negative psychological impact and increasing the financial costs of managing these caseloads.

Since introducing Farco-fill Protect to this patient group, the life of their catheters has been extended, catheter changes can be undertaken to a more consistent schedule and all patients involved in the evaluation of the product have reported a reduction in the pain and discomfort previously reported. From the case histories described above, it would appear that the introduction of Farco-fill Protect has also negated the need for, or at least reduced the frequency of, the use of catheter maintenance solutions.

CONCLUSION
All patients should have an individualised assessment and treatment plan when considering bladder drainage. Many patients will not have any issues when using urinary catheters, particularly short-term catheters. However, as the case histories outlined above demonstrate, there is a cohort of patients where the introduction of an indwelling catheter creates difficult-to-manage complications. The use of a product such as Farco-fill Protect in these circumstances can lead to an improvement for patients and is a useful tool in the armoury of any community nurse involved with managing problematic complex catheters.

REFERENCES

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