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ELDER CARE

A Resource for Interprofessional Providers

Chronic Urinary Catheters – Troubleshooting Blockage

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Urinary catheterization is commonly used in medical settings as a way to maintain or measure urinary output. However, as a consequence of multi-morbidity and complex chronic illnesses, there are challenges involved when long-term urinary catheterization is used in older adults.

It is estimated that 3% of older adults living in the community and 12% of those in residential care facilities use chronic catheterization for urinary drainage. And, it is estimated that over 90% of chronic catheter patients are colonized with bacteria that can cause catheter clogging. This Elder Care will review the development of catheter bacterial colonization, discuss how biofilm and encrustation lead to clogging, and discuss the evidence supporting interventions for dealing with clogged urinary catheters.

Chronic catheterization changes the normal bladder environment in several ways. First, constant catheter drainage prevents the usual filling and flushing cycle that removes bacteria from the bladder. Second, catheters are foreign bodies that cause irritation and mechanical injury to the urothelial lining. This disruption allows for bacteria to adhere to urothelial and catheter surfaces and begin multiplying to form colonies. A slimy matrix called biofilm develops around the bacterial colony, creating a microbiome that allows for nutrient absorption, protects bacteria from pH changes, and prevents antibiotic penetration. Pieces of the bacterial colony can break off and become floaters that block the lumen of the catheter. Third, some species of bacteria (notably *Proteus mirabilis*) produce urease, an enzyme that breaks down urea into ammonia. Ammonia alkalinizes the urine, allowing for precipitation of struvite and calcium phosphate crystals. These further encrust and strengthen the biofilm (and can also lead to bladder stones).

Complications from these processes can include bladder irritation, catheter clogging, and sometimes life-threatening catheter-associated urinary tract infections.

To avoid these outcomes, the best solution is to avoid long–term catheterization. Always question the need for chronic catheters, and work to remove them whenever possible.

If catheter placement becomes essential, standard care can help to minimize problems (Table 1).

Table 1. Standard Catheter Care

- Maintain a closed system
- Maintain dependent drainage
- Employ proper emptying technique
- Perform daily catheter care/perineal care
- Empty the bag when less than 50% full
- Use "clean" technique/good hand washing
- Provide adequate hydration
- Individualize the catheter change interval

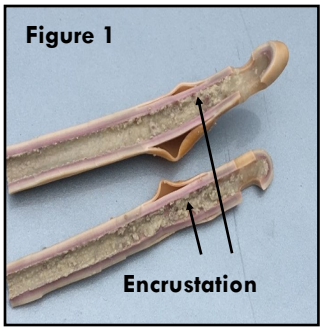
Despite best efforts, however, clogging of urinary catheters can still occur. The following discussion will review evaluation and treatment of catheter blockage.

Evaluation of Clogged Catheters

Again, the first step in catheter evaluation is to question the need for the catheter. If not essential, catheter removal and a voiding trial should be attempted. Other options are external catheters or clean intermittent catheterization.

Next, a chart review will provide the history of catheter placement, the interval at which the catheter is changed, and current interventions (e.g., flushing). Existing catheter care must then be assessed with the patient and caregiver.

Finally, the catheter site must be inspected and then the catheter removed. Dissection (slicing lengthwise) of the catheter allows visualization of biofilm or encrustation (Figure 1). Place a new catheter, if needed. If no debris is present, consider constipation, bladder spasm, kinked tubing, or a displaced catheter as other causes of failed drainage. Obtain a clean urine sample for urinalysis to determine pH and to assess the sediment. A culture can be helpful to identify the organisms present, not just to guide antibiotic therapy.



TIPS FOR DEALING WITH BLOCKED URINARY CATHETERS

- The first step is to question "Is this catheter really necessary?"
- If a catheter is necessary, adequate hydration is essential to prevent clogging.
- Changing the size and type of catheter can help to solve problems with irritation, leakage, and blockage.
- There is no evidence to support catheter flushing or oral acidification of the urine to prevent catheter blockage.
- Catheter dissection to evaluate for biofilm or encrustation will help to guide treatment, such as the addition of citrate.

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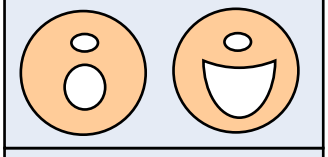
Interventions

Below are commonly attempted interventions and the current evidence supporting them (Figure 3).

Choice of Catheter Irritation, leakage, and blockage are sometimes related to the type of catheter. The most frequently used catheters for chronic use are made of hydrogel-coated latex; they absorb water to provide a lubricated surface for delicate mucous membranes. Sometimes, however, latex sensitivity can cause mucosal irritation and hyperplasia, in which case silicone catheters are preferred. Silicone catheters have a 45% wider lumen (Figure 2) than latex for the equivalent size French (F), but they are stiffer and less flexible than latex.

Figure 2. Catheter Lumen



Latex hydrogel Silicone

Catheter size can also make a difference. Each time a catheter size is increased (e.g., from 16 to 18 F), the inner lumen increases by 20%. While increasing catheter size can improve flow, it can also cause bladder spasms. Current evidence does not support the use of silver impregnated catheters for bacterial control.

Citrate for Encrustation Citrate, a chelating agent, can help with catheter encrustation but not with biofilm. It works by preventing the precipitation of divalent cations from solution. The best source of natural citrate is found in lemon juice (15-30 ml/day mixed with water). Oral potassium citrate can also be prescribed at 30-60 mEq/day.

Flushing Flushing to prevent clogging seems intuitive. It is often attempted to prevent catheter blockage. Flushing, however, opens the closed system, potentially introducing bacteria. Flushing solutions can irritate the bladder lining. Antimicrobial flushes can lead to more resistant organisms. Flushing agents also do not penetrate the biofilm. Current evidence does not support flushing with pH-balanced solutions, antimicrobials, or saline to prevent clogging.

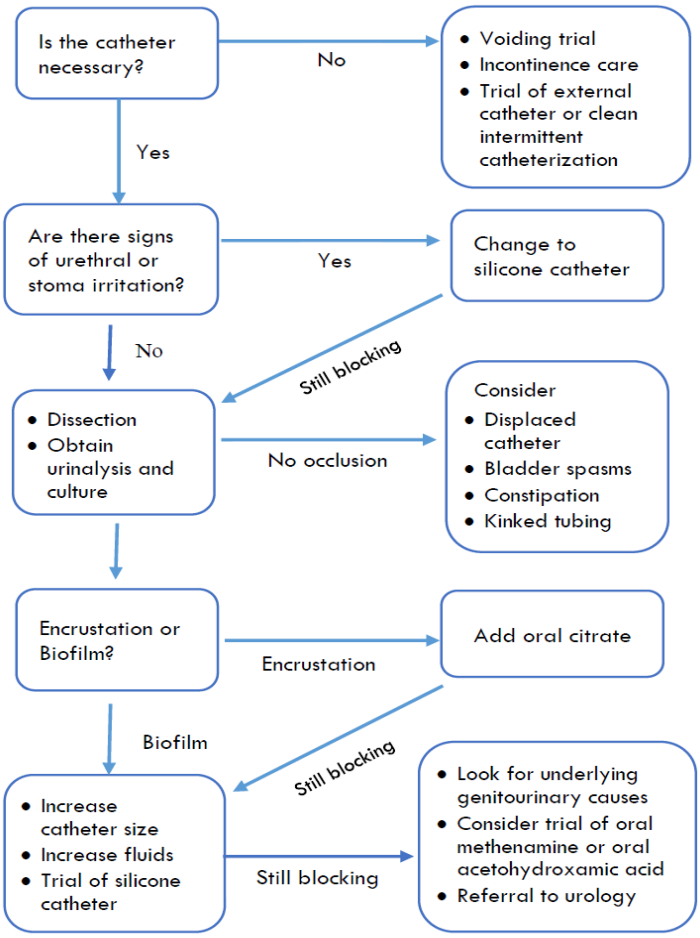
Oral Acidification of the Urine It takes a large oral acid dose to make even small urinary pH changes. There is no evidence that changing the urinary pH affects the pH inside the biofilm. Therefore, oral acidification agents such as ascorbic acid are not recommended.

Cranberry Cranberries contain phytonutrients called proanthocyanidins that prevent bacterial adhesion to uroepithelial cells. There is some evidence that cranberries may be mildly beneficial for preventing bacterial colonization at high dose, but evidence is inconsistent and cranberry juice has a high sugar content.

Antibiotics Judicious use of oral antibiotics can sometimes be helpful to reduce colony counts in difficult cases, but evidence is limited.

Other Oral methenamine breaks down into formaldehyde in acidic urine, and oral acetohydroxamic acid blocks urease activity. Both agents can help prevent blockage.

Figure 3. Algorithm for Managing Catheter Blockage



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