Queensland Spinal Cord Injuries Service

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Fact Sheet

Preventing Catheter Blockages: A Guide for Health Professionals

SPOT Spinal Outreach Team

Introduction

- Long term catheterisation is common for someone with a spinal cord injury (SCI). However, it poses a concern as this method of bladder management is associated with a number of complications. One such complication is catheter blockage. If left untreated, blockage can be life threatening.
- Recurrent blockage is a problem which is both distressing to client and caregivers. It hampers the client's confidence as the client faces a risk of a medical emergency if they are left alone. For someone who requires assistance to manage their catheters this can be quite daunting. Frequent and unplanned catheter changes can be costly to health services in terms of time and resources. Any assistance after hours requires the client to access their local emergency centres.
- Identification of the specific causes of catheter blockages allows appropriate management strategies to be instituted thereby reducing the likelihood of recurrence.

Causes and Recommendations

Low Urine Volume

- Smaller volumes of urine cause higher concentrations of debris which can lead to blocking
- Oral intake as well as output such as sweating can affect output volume

Recommendations:

- Ensure a consistent fluid intake – 2-3 litres of water a day is recommended

Poor Urine Flow

- Poor flow can lead to an increase in the incidence of encrustations as the urine:
  - settles in the tubing, promoting blockage from static debris
  - has more contact time with the catheter which causes a biofilm to form

Recommendations:

- Empty the drainage bag regularly as flow can be affected when the bag is two thirds full
- Promote free drainage by ensuring no kinks in the tubing and that the drainage bag is lower than the bladder
- Elevate feet during the day to reduce lower limb oedema
- Ensure a constant intake of fluids
- Limit diuretics such as caffeine and alcohol

Colonisation and Biofilms

- Bacteriuria or colonisation of the urine can develop as soon as 48 hours after the catheter is inserted
- Colonisation is common with E coli, Pseudomonas aureginosa, Proteus, Klebsiella, Provedincia.
- Bacteria floating in the urine are planktonic and can be treated with antibiotics
- A biofilm is a living layer that is described as being slimy and glue-like and is caused by the micro-organisms colonising on the synthetic surface of the catheter and tubing
- The growth of the biofilm is promoted by the moist environment. Poor urine flow also allows longer contact time with the bacteria and the catheter to form the film

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- The bacteria that form the biofilm are genetically different as they produce secretions that 'cement' the biofilm making it impervious to antibiotic therapy
- The urine can re-colonise after antibiotic treatment has been completed
- Despite having a closed urinary drainage system, colonisation can develop within four weeks of the catheter change

Recommendations:

- Maintain clean catheter technique when changing catheters
- General hygiene is also important
- A closed catheter system postpones bacteriuria or bacteria growth in the urine. A closed system is a one way flow of urine from the bladder and there are no breaks in the system
- Regular catheter changes of 4-6 weeks will prevent colonisation
- If possible, change the catheter when commencing antibiotic therapy
- Medications that have anti-bacterial properties such as cranberry, D- Mannose and hiprex may prevent colonisation of the urine (although evidence is limited). Check for interactions with medications before recommending commencement of same.

Alkaline Urine

- The normal pH averages 6.0 but can range from 4.5—8.0.
- There is considerable encrustation at pH less than 6.7
- The activity of urease is dependent on pH. Urease is more active in an acid pH causing more urea to convert into ammonia
- Ammonia in solution is alkaline
- Ammonia also damages the protective layer of urothelial cells which defend against infection
- Urease producing bacteria are:
  - Proteus mirabilis, Morganella morganii, Provedencia stuartii, Klebsiella pneumoniae, Proteus rettgeri, Proteus vulgaris, Staphylococcus aureus
- Urease producing bacteria also lead to a higher risk for stone formation
- There is no evidence to suggest a balanced diet and moderate intake of food groups has any bearing on urine pH
- Medications and oral solutions such as antacids, effervescents and diet drinks contain citrate and can cause the urine to be more alkaline

Recommendations:

- Take a measurement of the urine pH
- Take a micro-urine to detect any urease producing bacteria
- If a urease producing organism is present, alkaline therapy such as citrates or sodium bicarbonate may reduce crystallisation and subsequent blockages

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Catheter Blockage Prevention Flow

Water Intake 2L—3L

YES

NO

- Increase input
- Limit diuretics such as alcohol and caffeine

Is the intake/output consistent?

YES

NO

- Regular intake of fluids
- Promote free drainage
- Review for peripheral oedema
- Mobilise client as able to promote flow

Client has a balanced diet?

YES

NO

- Increase vegetables in the diet
- Increase fibre in the diet
- Review and eliminate excesses of animal proteins, sodium, processed sugars and calcium
- Check renal ultrasounds

Is the urine colonised?

YES

NO

- Check renal ultrasounds

Urine pH > 6.7

YES

NO

- Review closed system and catheter technique
- Antibiotic treatment only if symptomatic
- Change the catheter 4-6 weeks
- Check renal ultrasounds

Urease producing organism present?

YES

- Alkaline therapy as indicated / prescribed
- Check renal ultrasounds

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Encrustation

- Encrustation is the development of crystals in the catheter tubing
- There are two types of encrustration. These are:
  - Struvite (magnesium ammonium phosphate)
  - Apatite (calcium phosphate)
- Calcium salts are a large component of catheter encrustations
- Struvite, not developed from a biofilm, is reversible. It is only reversible if the urine is low in phosphate, magnesium and calcium salts or the urine is acidified.
- Non blockers have a wider safety margin between their normal urine pH and that at which crystallization occurs (~1.4 variance in pH)
- The phosphate precipitates or separates in the solution and stops forming crystals. This happens in alkaline urine and starts at pH values of 6.7 and peaks at pH of 7.5

Recommendations:

- Antibiotic therapy is not effective with encrustation and long term use can lead to developing resistant bacteria
- Encrustations are less pronounced on silicone and hydrogel catheters
- Moderate the intake of magnesium and calcium in the diet. Magnesium is found in diet soft drinks, herbal teas and fruit juices. A high calcium diet also contains more potassium, phosphate and magnesium which can contribute to the encrustation
- Performing a bladder washout with saline or water to remove the debris or crystals has limited supporting evidence and is more likely to cause spasm and mucosal irritation.
- Some commercial acid-based and antimicrobial irrigation preparations can be helpful (e.g. Suby G/R, Microdox, PHMB) if administered as per the manufacturer's recommendations.

KIDNEY STONES

Oxalate Stones

- The most common stone is the calcium oxalate stone (~80%)
- Calcium oxalate stones are usually passed spontaneously
- Oxalate is detected in:
  - seeds (cereals/grains)
  - leaves (spinach)
  - roots (beets)
- Low levels of oxalate are in peas, corn, broccoli, oranges and cornflour
- Half of the urinary oxalate is sourced from the diet
- An increase in oxalate absorption in people who form stones can be caused by an absence of oxalate degrading bacteria in the digestive tract
- Other factors in the development of the stones are:
  - Urinary stasis
  - Intermittent high levels of oxalate
  - Immobilisation
  - Metabolic disorders
- A diet high in sodium, processed sugar and protein increases calcium in urine

Recommendations:

- An annual kidney ultrasound and x-ray is recommended
- Increase vegetable and water intake

Diet and Kidney Stones

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Ammonium magnesium phosphate stones

- Ammonium magnesium phosphate stones are better known as infection stones and have a higher risk of recurrence
- These stones containing ammonium magnesium phosphate and calcium phosphate are secondary to an infection with a urease producing bacteria
- Staphylococcus aureus and Proteus are the most common causes of stones

***Recommendations*:**

- Prevent recurrent urinary tract infections

Uric Acid Stones

- Uric acid stones are formed from purine ingestion (beer and animal protein) and a diet high in carbohydrates and phosphorus
- The stones also develop in conjunction with other factors such as urinary stasis, obesity and low urine pH
- The low urine pH is caused by a high dietary intake of animal proteins

Recommendations:

- An annual kidney ultrasound and x-ray is recommended
- Increase intake of vegetables and water

Check List

Is the client:

- Drinking 2-3 litres of water a day at regular intervals
- Maintaining a free-flowing drainage system
- Eating a well-balanced diet
- Maintaining a clean and closed system
- Changing the catheter at least every 4-6 weeks or when commencing antibiotic therapy
- Mobilising as able
- Taking appropriate medications

Clinical Investigations:

- Test urine pH
- Take a micro-urine
- Have regular yearly kidney ultrasounds and x-rays and have the test results checked by a specialist

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