

# CATHETER CARE GUIDELINES.

The Australian and New Zealand Urological Nurses Society Inc. (ANZUNS) is a group of dedicated Urology Nurses, committed to the delivery of best practice. ANZUNS recommendations for the insertion and care of urinary catheters have been developed to support existing organisational guidelines. They are based on current clinical practice Australian and New Zealand wide and where possible supported by published research articles.

The information contained in this document is strictly for educational purposes and does not supersede individual institutions policy and procedure guidelines. The authors take no responsibility for any adverse events incurred as a result of using information within this document

## **Responsibility of health care workers**

- To acquire adequate training to carry out the procedure (defined by place of work)
- Accurate assessment of specific clinical indication for catheterisation.
- To minimise the trauma and infection risk associated with inserting and maintaining urinary catheters.
- To minimise psychological trauma to the patient

## **Indications for Urinary Catheterisation (*but are not limited to*)**

1. Relieve urinary retention acute/chronic
2. To empty the bladder prior to surgery/investigations
3. To instil medication
4. Determine residual volume in the absence of ultrasound equipment
5. Irrigate the bladder
6. To keep perineal area dry to assist healing
7. Determine accurate fluid balance
8. To collect a sterile specimen of urine.
9. For investigations of the lower urinary tract eg. Urodynamics
10. Management of intractable incontinence
11. Instrumental delivery
12. To allow healing following lower urinary tract surgery
13. Comfort for the terminally ill

(Stewart 1998)

Initial catheterisation should be in consultation with a medical practitioner.

## **Precautions**

- Undergoing surgery for heart valve replacements or orthopaedic surgery involving joint replacements.
- Patients with existing heart valve/joint replacements may require antibiotic cover.
- Distortion of the urethra due to recent urethral/prostate surgery or trauma, urethral strictures.
- Urinary catheterisation is a last resort for long-term continence management, to be used when other management strategies have been exhausted.

## **POSSIBLE COMPLICATIONS**

- Inability to catheterise
- Urethral Injury – by inflating balloon before insuring correct catheter placement in the bladder
- Infection
- Psychological Trauma
- Haemorrhage – trauma sustained during insertion or balloon inflation
- False Passage – by injury to the urethral wall during insertion
- Urethral Strictures – following damage to the urethra – long term problem
- Paraphimosis due to failure to return foreskin to normal position following catheter insertion.

(Blitz 1995)

## **TERM OF CATHETERISATION (Intermittent, Short, Long Term)**

Catheterisation can be divided into three groups according to the length of time in use. An indwelling catheter (IDC), should be left in situ for the minimum possible time.

### **1. Intermittent:**

The catheter is inserted and removed immediately after emptying the bladder.

- To relieve acute urinary retention or when medically indicated to obtain a urine specimen, or to check post void residual bladder volume.
- People who self catheterise should continue to do so if possible during hospitalisation. While in a hospital setting a new catheter should be used each time due to an increased risk of infection. (Laker 1995)
- Self catheterisation is for regular emptying of the bladder. Used mainly in the community to maintain bladder function by complete bladder emptying. As a clean procedure, each catheter is usually used for a week. (Laker 1995) The TGA have approved reuse of catheters in the home setting. (CFA conference Nov 2005)
- Self catheterisation is also used in the management of urethral strictures for dilatation purposes.

## 2. Short Term Catheterisation –

- The catheter is left in situ for up to one week eg. In a pre-operative and immediate post operative period to monitor urinary output, or if medically indicated.
- The majority of hospitals represented at the AUNS Catheterisation SIG workshop use latex based silicone coated catheters for short term use except in the instance of latex sensitivity or allergy when 100% silicone catheters should be used

## 3. Long Term Catheterisation – 6 weeks to 3 months

- Hydrogel coated catheters, or 100% silicone catheters are recommended for long term use.
- Use 100% Silicone for patients with latex allergy
- Suprapubic catheterisation may be preferred depending on the individual patient's circumstances

(Marsden Manual 2001)

Long term catheters should be changed on an individual needs basis and not strictly by time. This can vary dramatically from individual to individual eg if the catheter regularly blocks you might anticipate a pattern and change the catheter prior. The longest duration a catheter should remain indwelling should be based on the manufacturers recommendations for catheter usage.

There can be significant individual variation in the length of time a catheter will remain functional. It is recommended that catheter changes are based on:

- Function of the catheter
- Degree of catheter encrustation
- Frequency of blockage
- Patient comfort

(Ostaszkiwicz 1997)

## CATHETER SELECTION

Each patient's individual needs should be considered carefully when selecting a catheter.

These include

Indication for catheterisation

Consistency of urine

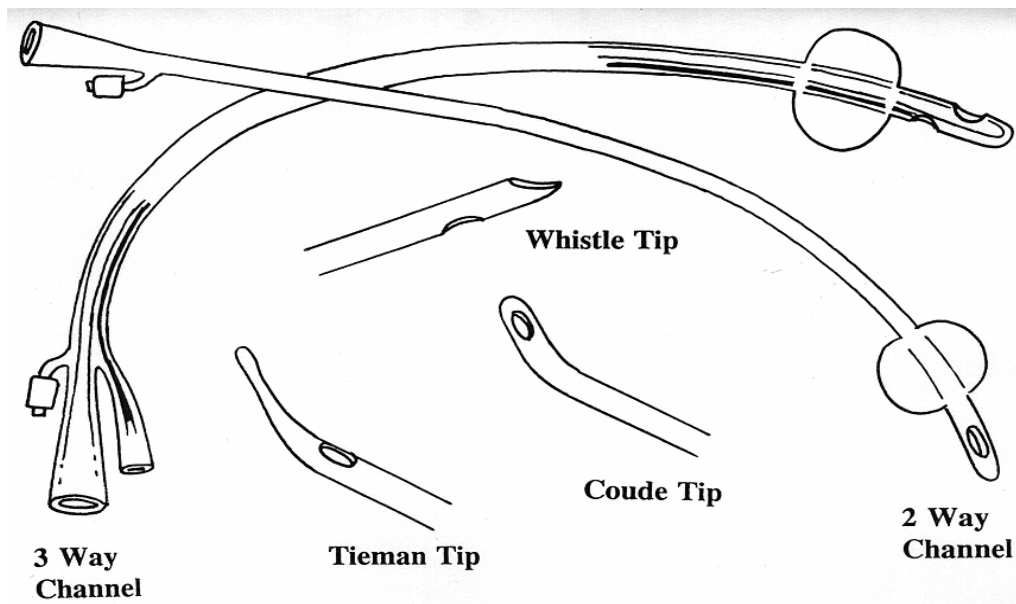
Anticipated duration of catheterisation

Type of catheterisation ie urethral or suprapubic.

([www.nhshealthquality.org](http://www.nhshealthquality.org) 2004)

## Catheter type

<u>Type</u>	<u>Indication</u>
Straight Nelaton	in/out use eg. Intermittent Self Catheterisation
A 2 way channel	routine drainage
A 3 way channel	where urine contains clot or debris, or for bladder irrigation
A rounded tip	routine drainage
A whistle tip	debris or clot drainage
Coude / tieman tip	
Specialist tips/ Mallecot –	rarely used.



(VUNS 1999)

## **Catheter materials**

All catheters used in Australia must conform to the Australian standard AS2696

- Polyvinylchloride or Polyurethane– Nelaton . for in/out use ie no retaining balloon
- Latex catheter silicone coated used for short term – in most institutions these catheters are changed weekly, however the manufacturers guidelines state that they may remaining indwelling for up to 1 month
- Hydrogel coated– changed up to 3 monthly, contains latex. They are well tolerated and are inert. Hydrogel coated catheters become smoother when rehydrated, reducing friction within the urethra. (Nacey and Delahunt 1991)
- 100%Silicone – changed up to 3 monthly, latex free (Marsden Manual 2001)

## **Catheter Size**

Choose the smallest catheter size that will drain adequately for its intended use

Catheters range in size from 5 – 24 Fg.

(Joanna Briggs Institute 2003)

General Guide:

Women 12 – 14 Fg

Men 16 – 18Fg

Suprapubic 16 –20Fg

Haematuria 20 -24 Fg

If a haematuria catheter is required a 3 –way should be used to allow for the option of continuous bladder irrigation without requiring a further catheter change. When not in use, the irrigating port should be spigotted.

## **Catheter length**

Catheters are available in 3 lengths: Paediatric, Regular length and Female length.

Female length is a shorter length catheter (20-25cm). A shorter length catheter may be more convenient for ambulant women with a long term catheter. A shorter length catheter is not appropriate for all women particularly those who are bedridden or obese. In obese women, the inflation valve of the shorter catheter may cause soreness by rubbing against the inside of the thighs, and the catheter is more likely to pull on the bladder neck (Britton & Wright 1990; Pomfret 1996)

## **BALLOON SIZE**

- Use the smallest balloon size possible. This keeps residual urine minimal, reduces the likelihood of bladder spasm, and minimizes damage to the bladder neck from the weight of the balloon. (Joanna Briggs Institute 2003)
- Balloon sizes: 5 – 30 mls. The most commonly indicated balloon size is 10ml. Always inflate the balloon to the manufacturers recommended volume indicated on the inflation valve of the catheter as well as written on the packaging. The balloon should be fully inflated to the recommended size. Under-inflated balloons may occlude the drainage holes of the catheter, or cause distortion of the catheter tip, leading to irritation and trauma to the bladder wall (Bard, 1987; Pomfret 1996). Fully inflate to ensure uniformity and then withdraw fluid if lesser balloon required for spasm thus no distortion.
- The 30ml balloon is designed specifically as a haemostat post urological procedure, and should not be used for routine catheterisation (Stewart1988)
- Inflate with sterile water. Air is not suitable as it will cause the balloon to float. Tap water is not sterile, and saline may block the inflation channel with crystals, making subsequent deflation difficult (Falkiner 1993)

## **CATHETER DRAINAGE BAG SELECTION**

Selecting a system involves

- Indications for catheterisation
- The intended duration
- Infection control issues
- Wishes of the patient  
(Wilson and Coates 1996)
- Dexterity of patient
- Mobility of patient

### **1. Disposable 2 litre plastic bags (night bag)**

- For general use.
- Catheter bags should have 120cm length tubing with an outlet port to allow emptying.
- It is recommended that catheter bags also have one-way valves to prevent urine backflow, and an access port for the collection of urine specimens.
- Bags should be changed when they become damaged, contaminated, malodorous and at catheter changes. ([www.nhshealthquality.org](http://www.nhshealthquality.org) 2004)

### **2. Disposable 2 litre closed system bag (hourly measuring bag) with sample port**

Used when frequent measurement of urine output is indicated. Tubing length should be 120cm. These are generally short term and only need to be changed if damaged,

contaminated or malodorous.

### **3. Disposable Leg Bags (500-750mls)**

- Designed for day wear and can be secured to the leg in a variety of ways eg straps, legi fix catheter bag holders strapped from the waist. (Leg bags can also be used to reduce trauma for the confused or forgetful patient while in hospital)
- Tubing on leg bags is available in different lengths and can be tailored to individuals requirements. Some people may choose to wear the leg bag on their thigh, others prefer to wear the leg bag on their calf. Again others may prefer “the bellybag”
- At night a clean night bag is attached to the bottom of the leg bag, providing a link system and allowing for greater drainage capacity. (Stewart, 1998) In the community the night bag is emptied and washed with warm water and mild detergent between uses.
- The general recommendation for changing disposable drainage bags is weekly or when they become damaged, odorous or have sediment in the bottom. ([www.nhshealthquality.org](http://www.nhshealthquality.org) 2004)

### **4. Disposable 4 litre plastic bags**

- Bags with non returnable valve. Used post operatively in urology and for bladder irrigation.
- Usually short term and only changed if damaged, contaminated or malodorous. (Wong 2001)

### **CATHETER STORAGE (existing guidelines - Victorian Urological Nurses Society Inc.)**

Inappropriate storage can cause damage to catheters. Therefore catheters should;

- lie flat, preferably in the manufacturers box, away from heat or sunlight
- not be bent
- not be grouped with rubber bands
- have expiry date checked before use (Rigby 1998)

### **INDICATIONS FOR SUPRAPUBIC CATHETERISATION (existing guidelines - Hollywood Hospital Perth)**

- To relieve acute urinary obstruction where a urethral catheter cannot be inserted into the bladder eg. urethral stricture
- To relieve chronic urinary retention eg enlarged prostate
- Relieve chronic retention of the neurogenic bladder
- For clients who require long-term catheterisation, who are sexually active, in a wheelchair, or have persistent problems with urethral catheters.
- During and following pelvic or urological surgery

In most cases the suprapubic cystotomy is a temporary measure. Once efficient urethral drainage has been instituted the catheter can be withdrawn and the fistula will close rapidly. (Peate, 1997)

Where the procedure is more permanent, the catheter should be changed every 10-12 weeks. (Scott et al 1975, Sheriff et al 1988)

### **advantages**

Suprapubic catheters have several advantages over urethral catheters. (McMahon 1998)

- They are easier to clean and change
- They are less likely to block
- They do not cause urethral damage
- They can be clamped rather than removed to assess the patient's ability to void via the urethra
- Risk of catheter contamination with micro-organisms commonly found in the bowel is reduced
- More satisfactory for female and wheelchair bound patients
- More appropriate in respect to a persons sexual activity (intercourse)

### **contraindications**

Although suitable for a wide variety of patients, they are inappropriate for those with;

- haematuria - the catheter may be unintentionally inserted through a bladder tumour
- obesity or ascites - siting and changing catheters may be problematic
- an inability to fill the bladder to a minimum of 300mls
- a history of lower abdominal surgery
- blood clotting disorders
- suspicion of an ovarian cyst

### **care of the suprapubic catheter**

Although the principles of care and management of the suprapubic catheter are similar to those of a urethral catheter, there are differences.

- the suprapubic catheter emerges at right angles to the abdomen and needs to be supported in this position
- dressing and tapes should only be used when absolutely necessary. If a dressing is required to secure the catheter it must be sterile and applied using an aseptic technique (Wilson 1995)
- Hygiene is important and once healed the site should be washed with warm soapy water, preferably twice daily (McMahon-Parkes1998). Cleaning should be directed away from the insertion site. Talc, creams and strongly perfumed soaps should be avoided
- Patients should be made aware of the importance of hand washing both before and after handling the catheter drainage system.

### **Technique for changing a suprapubic catheter**

A new suprapubic tract usually takes between 10 days and 4 weeks to become established, after which time the catheter may be changed safely. Most institutions would wait until 4 weeks prior to the first change of SPC.

Long term catheters should be changed on an individual needs basis and not strictly by time once the suprapubic tract has healed. This can vary dramatically from individual to individual eg if the catheter regularly blocks you might anticipate a pattern and change the catheter prior. The longest duration a catheter should remain indwelling should be based on the manufacturer's recommendations for catheter usage. Refer to the reference below for "how to change a suprapubic catheter".

(Queensland Government Queensland Health 2002)

## **CATHETER MANAGEMENT**

### **Bladder washout (existing guidelines VUNS Inc.)**

Routine bladder washouts should only be attended if there is a clinical indication for doing so. eg clot evacuation

There is ongoing controversy over the instillation of solutions into catheterised patients. The use of maintenance solutions should be based on research (Getliffe 96)

A catheter flush is a prescribed procedure using a specific amount of fluid. Indications for catheter flushing are different to bladder washout and are used to maintain patency of a catheter, and are used for flushing and not withdrawing. (Getliffe 1991)

### **Fluid Intake**

To assist in maintenance of catheter patency, a general recommendation is 1 - 1.5 litres daily (Getliffe 1994)

However, the amount of fluid intake recommended for an individual needs to be considered in the context of that individual's medical status and physiological requirements. (Hedelin et al 1989, Getliffe 1993)

Some patients may benefit from the acidifying of the urine with cranberry juice/capsules, vitamin C or Hiprex (antibacterial). (Avorn et al 1994)

### **Bowel Care**

Good bowel care involves assessment of normal bowel habit, avoiding constipation and straining, and discussing dietary intervention. The use of antispasmodic drugs may increase the likelihood of constipation. (Rigby 1998)

Bowels should be opened regularly without straining to avoid;

- bladder spasm
- catheter bypassing
- catheter blockage

## **DOCUMENTATION**

Details regarding the catheterisation should be recorded in the patient's notes. For further information please refer to your hospital's policy and procedure manual. The following is a guide only.

The procedure is documented in the patient's medical records and signed by the person inserting the catheter. Notes should include:

- Indication for catheterisation
- Time and date of catheterisation
- Type of catheter
- Amount of water in balloon
- Size of catheter
- Expiry date of product
- Any problems on insertion
- Description of urine, colour and volume drained
- Specimen collected
- Review date

(Marsden Manual 2001)

Information for patient relevant for discharge into the community

- Patient handout on "managing your catheter"
- Anticipated date of catheter change and who will carry it out.
- Who to contact if problems arise with catheter (acute and non-acute)

Information required for health provider responsible for catheter care

- Indication for catheterisation
- Type of catheter
- Gauge and balloon size
- Batch number and expiry date
- Expected date of next and/or subsequent catheterisation, where this will take place, and carried out by whom.

## **Appendix 1**

### **CATHETERISATION PROCEDURE, MALE AND FEMALE**

This is a guide only. Please refer to your hospitals policy and procedure manual.

#### **EQUIPMENT REQUIRED**

1. Dressing trolley
2. Catheterisation pack
3. Sterile gloves
4. Appropriate size catheter
5. Xylocaine jelly syringe
6. Sterile water for the balloon
7. Syringe
8. Specimen jar
9. Antiseptic solution
10. Waterproof Sheet
11. Extra Jug
12. Light source
13. Tape to secure the catheter to the leg
14. Drainage bag
15. Urine bag holder

#### **PROCEDURE - Female and Male Catheterisation**

1. Discuss procedure with patient and gain verbal consent
2. Ensure patient privacy and keep warm at all times.
3. Ensure a good light source is available
4. Place a waterproof sheet under buttocks, aim for minimum exposure.
5. Assist patient into the supine position.
6. If soiling evident, clean genital area with soap and water prior to procedure
7. Perform an aseptic hand wash, assemble equipment.
8. Set up trolley. Open catheterisation pack and using an aseptic technique add catheter and other sterile equipment, pour antiseptic onto tray.
9. Perform aseptic hand wash and don sterile gloves.

#### **Steps 10 to 14 for Female**

- 10F Assist pt into the supine position with knees bent, hips flexed and feet resting about 60cm apart.

- 11F Apply the drapes. The paper one is placed on the bed between the thighs and the fenestrated drape (drape with central access hole) is placed over the urethral orifice.
- 12F With your non-dominant hand, separate the labia minora to expose the urethral meatus (this hand is now considered contaminated and should remain in this position until the procedure is completed). Using gauze swabs held with forceps, clean both the labia folds and the urethral meatus. Move swabs from above the meatus down towards the rectum. Discard each swab after each downward stroke. Insert lubrication into urethra
- 13F Place the sterile tray onto the drape. The end of the catheter should be resting in the tray.
- 14F With dominant hand, insert the catheter into the meatus, upward at approx 30 degree angle until urine begins to flow.
- 15F Advance the catheter as far as comfortable possible (approx 6-8cm) to avoid inflating the balloon in the urethra.

### **Steps 10 to 14 for Male**

- 10M Apply the drapes. The paper one is placed over the thighs just below the penis and the fenestrated plastic sheet is placed with the hole over the penis.
- 11M With your non-dominant hand lift the penis (this hand is now considered contaminated and should maintain a firm grasp until the procedure is completed). If non-circumcised retract the foreskin. Using your other hand, clean the meatus with gauze swabs held with a forcep. Use a circular motion, moving from the meatus to the base of the penis.
- 12M Slowly insert the xylocaine gel into the urethra Hold the distal urethra closed and wait 2 - 3 minutes to give the gel time to work (if post-urology surgery consider using two syringes).
- 13M Place the sterile tray onto the drape.
- 14M Hold the penis with slight upward tension and perpendicular to the patient's body; insert the catheter with your dominant hand. When the first sphincter is reached (at level pelvic floor muscles), lower the penis 90 degrees (facing patient's toes), apply constant gentle pressure (if resistance is felt the following strategies should be used)

### **Consider**

- 2<sup>nd</sup> tube of lubricant:
- Increase the traction on the penis and apply gentle pressure on the catheter;
- Ask the patient to take a deep breath;
- Ask the patient to cough and bear down eg try to pass urine
- Gently rotate the catheter.

### **DO NOT USE FORCE AS YOU MAY DAMAGE THE URETHRA**

Advance the catheter to the bifurcation (Marsden 2001)

### **For both Female and Male**

15. Inflate the balloon slowly using sterile water to the volume recommended on the catheter (Bard 2001), checking that no pain is felt by the patient. If there is pain, it could indicate the catheter is not in the bladder - ***always ensure urine is flowing before inflating the balloon.***

16. Withdraw the catheter slightly till resistance is felt and attach to the drainage system.
17. Secure the catheter to the thigh/abdomen with tape.
18. Reposition the foreskin if applicable.
19. Ensure the patient is left dry and comfortable.
20. Remove gloves and dispose of equipment in a yellow biohazard bag.
21. Perform a social hand wash.

### **Watchpoints**

- Rapid drainage of large volumes of urine from the bladder may result in hypotension and/or haemorrhage.(Upson 1995) Clamp catheter if the volume drained is 1000mls or greater. After 20minutes release the clamp and allow urine to drain. If the amount of urine is 1000mls or greater repeat the clamping procedure.
- For Post Obstructive Diuresis, may require IV replacement of electrolytes. (Walker 1990)

## **Appendix 2**

### **COLLECTION OF CATHETER SPECIMENS**

#### **Indications**

- Signs and symptoms of a urinary tract infection (IDC insitu)
- Pyrexia of unknown origin (IDC insitu)
- Urosepsis or sepsis of unknown origin

#### **Procedure**

1. Clamp drainage tube just below the connection, for no longer than 30 minute (Perry and Potter 1998)
2. Wash hands and dry hands thoroughly.
3. Assemble equipment.
4. If specimen of urine is obtained immediately following the insertion of an IDC, before the catheter bag is attached, the urine can drain directly into the specimen container. Ensure the lubricating jelly drains away first. Ensure the catheter does not touch the sides of the collection container.
5. Otherwise use one of the methods below (preferably access a sample port, which is only available on most catheter drainage bags. Follow method number one). Collect approximately 3mls -a minimum of 1ml is required for satisfactory testing. (Laker 1995)
6. Don non-sterile gloves

#### **Method 1 (preferred)**

- Clean entry port with alcohol swab using firm friction and allow to air dry
- Insert syringe into direct entry point of bag and aspirate urine. The port will self-seal when the syringe is withdrawn.
- If direct syringe entry port is not available, insert needle into entry port and aspirate urine. The port will self-seal when the needle is withdrawn

#### **Method 2**

- Insert needle at a 30-degree angle, on the opposite side to the balloon port, just above where the catheter is attached to the drainage tube
  - Aspirate urine
  - The catheter will self-seal when the needle is withdrawn
7. Carefully remove the needle from the syringe and dispose of directly into sharps container
  8. Carefully empty urine filled syringe into specimen container
  9. Release catheter clamp
  10. Dispose of surplus equipment.
  11. Remove gloves and dispose.

12. Wash and dry hands thoroughly.
13. Label specimen container with patient details, specimen type, date and time of collection. Place in biohazard bag and seal.
14. Complete lab form. Note in particular if patient is on antibiotic therapy.
15. Arrange for transport to the laboratory or refrigerate sample.
16. Document in patient record rationale for collection of urine sample and date & time taken.

Disconnection of the catheter bag is not recommended.

***The next two headings are subject to individual institutions guidelines.***

## **PROCEDURE FOR EMPTYING CATHETER BAGS**

Standard Precautions and Principles of asepsis to be used as follows :

- Wear disposable gloves. Remove gloves and wash hands between each patient.
- When emptying catheter bags with gloved hands, avoid interruption and potential contamination of other equipment etc. until task is completed and hands are washed.
- Use a clean jug large enough to avoid spillage eg 2-3 litres.
- After emptying the bag, wipe the end of the catheter outlet with an alcohol swab.
- Note the amount and colour of drainage – record prn.
- Empty jug carefully down the sluice to avoid splashing
- Place jug straight into sanitiser and store dry

(Marsden Manual 2001)

## **PROCEDURE FOR CHANGING CATHETER BAGS IN HOSPITAL**

Bags are dated using waterproof vivid pen (not biro)

Principles of asepsis to be used at all times as follows :

### **Collect equipment eg.**

Disposable gloves, alcohol wipes, clean guard or paper towel, new urinary drainage bag (dated).

## **PROCEDURE**

Have equipment ready

Wash hands

Put on gloves

Place guard or paper towel under catheter outlet port

Wipe end of catheter with alcohol wipe and allow drying for 20 seconds

Squeeze catheter outlet to prevent leakage

Disconnect catheter from tubing

Using non touch technique insert new tubing connection into catheter

Place used bag into receiving jug or similar

Ensure urine is draining

Tubing should not be pinned to the bed clothes

Ensure that the catheter bag is well supported and draining below bladder level

## **PRINCIPLES INFECTION CONTROL**

- Catheterisation of the urinary tract should only be done when there is a specific and adequate clinical indication, as catheterisation carries a high risk of infection.
- Strict aseptic technique is essential. Hand washing is the primary defence against infection. A bacteraemia secondary to insertion of a catheter occurs in a 20 – 30 % of patients. The risk of infection is related to the method of insertion, duration of catheterisation, quality of catheter care and patient susceptibility. (Dept of Health, 2001)
- A urine specimen for culture is taken only when clinically indicated. An aseptic technique is used.
- If cultured, most urine from patients with an indwelling urinary catheter would show a degree of bacteria. These catheter-associated urinary tract infections in otherwise healthy patients are often asymptomatic, and likely to resolve spontaneously when the catheter is removed. (Wong 2001)
- Standard Precautions are maintained when in contact with urine and /or other body fluids. Gloves are changed between patient contacts and hands washed and dried adequately.
- Gravity is important for drainage and the prevention of urine backflow. Ensure that catheter bags are always draining downwards, do not become kinked and are secured and below thigh level. Metal or plastic hangers should be attached to the side of the bed. Cloth bags tied to the bed to support the bags are also available
- Cloudy, offensive smelling or unexplained blood-stained urine is not normal and needs further intervention.
- Prophylactic antibiotic cover for indwelling catheters is rarely necessary.
- Daily warm soapy water is sufficient for meatal care or prn if build-up of secretions is evident. Uncircumcised men should gently ease down foreskin over catheter after cleaning.

- A fluid intake which keeps the urine dilute will help lessen the risk of infection and prevent catheter blockage. (approx 2 litres/day)
- Adherence to a sterile continuously closed method of urinary drainage has been shown to markedly reduce the risk of acquiring a catheter associated infection.

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