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Announcement

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Contents:

Catheter Associated Urinary Tract Infection (CAUTI)

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Introduction:
Indwelling urinary catheter is a commonly used device for different patients in various setting. A urinary tract infection (UTI) is an infection involving any part of the urinary system, including kidney, ureters, bladder and urethra. Nearly 40% UTIs are hospital acquired infection (HAI). Among UTIs acquired in the hospital, approximately 75% are associated with an indwelling urinary catheter[1] . Indwelling urinary catheter, as a foreign body, allows bacteria to colonize and enter the body. It is well established that the duration of catheterization is directly related to risk for developing CAUTIs. Microbial colonization occurs within five to seven days of catheter placement and is frequently associated with the development of biofilm, presumably the source of CAUTI. Each day the indwelling urinary catheter remains, a patient has a 3-7% increased risk of acquiring a CAUTI[2,3]. Therefore, catheters should only be used for appropriate indications and should be removed as soon as they are no longer needed. In order to prevent CAUTI, a series of bundle action is important to implement.

Asymptomatic bacteriuria (ASB) vs symptomatic bacteriuria:
According to the Centers for Disease Control (CDC), the definition of CAUTI is a UTI where an indwelling urinary catheter was in place for more than two calendar days on the date of event, with the day of device placement being as Day 1.

UTIs can be divided into asymptomatic bacteruria (ASB) and symptomatic bacteruria. The Infectious Diseases Society of American (IDSA) defines ASB in catheterized specimen in women or men, a single specimen with isolation of one bacteria species with at least 10^5CFU/ml of a patient without signs and symptoms of a UTI. ASB is common in nursing home and people with long term indwelling urinary catheters. Avoidance of antimicrobial use in patients with ASB where there is no benefit of therapy is preferred to minimize antimicrobial adverse effects and limit emergence of antimicrobial resistance which may restrict future therapeutic efficacy for treatment of urinary tract or other infections[4,5].

Presence of symptoms in a patient having UTI is referred to as symptomatic bacteriuria. Patient with symptomatic bacteriuria with culture growth of ≥ 10^3CFU/ml of uropathogenic bacteria. Systemic antibiotic treatment is indicated only for symptomatic bacteriura.

For patient with indwelling urinary catheter, we should not rely on dipstick or smell urine (100% colonization risk at 7-10 days). Dipstick can modestly improve diagnosis but cannot adequately to rule out UTI. Urine dipstick for nitrite which indicates bacteriuria while leucocyte esterase detects pyuria. (Pyuria may result from other imflammatory disorders of the genitourinary tract). Dipstick for nitrites is also of limited usefulness because of infection with non-nitrite producing organisms, urine incubated for at least 4 hours in bladder and urine pH <6. The combination of the dipstick for nitrites and leukocyte esterase is more specific for ASB than either test alone.

Signs and symptoms of CAUTI[6]:
-Cloudy urine
-Haematuria
-Smelly urine
-Fever
-Chills and rigor
-Bypassing
-Burning or pain in the lower abdomen
-unexplained fatigue
-Confusion or delirium in elderly

Causes of CAUTIs:
Urinary catheter should not be left in the bladder in longer than needed, as longer use is associated with a high risk of infection. There are a number of ways infection can occur during hospitalization. The catheter may become contaminated upon insertion. Moreover, bacteria from a bowel movement my get on the catheter. Nevertheless, urine in the drainage bag may flow backward into the bladder or the catheter may not be regularly cleaned.

Burden of CAUTIs:
The burden of CAUTI is substantial with regard to discomfort to patient, prolonged hospital length of stay, increased health care cost and mortality. According to European studies, 15-25% of hospitalized patients and 5% of patients in elderly homes have an indwelling urinary catheter. Studies showed that 41-58% of catheters in place are probably unnecessary[7].

Pathogenesis:
Most UTIs result when bacteria gain access to the urethra via the urethra. CAUTI remains one of the most common types of HAI. Further progress in the prevention of CAUTI requires a better understanding of its pathogenesis. Urinary catheters can become colonized through several routes: extraluminal and intraluminal routes. Extraluminal colonization may occur by direct inoculation when the catheter is inserted or it may occur later by organisms ascending in the mucus film between the catheter and the urethra. Intraluminal colonization occurs by reflux of organisms from a contaminated drainage bag or by a break in the closed drainage system. Once organisms gain access to the catheterized urinary tract, the level of bacteriuria usually increases to more than 10^5 cfu/ml within 24 to 48 hours in the absence of antimicrobial therapy. Indwelling urinary catheters frequently become colonized with micro-organisms but the majority of cases are asymptomatic. Formation of biofilms by urinary pathogens common on the surfaces of catheters and collecting systems. Moreover, bacteria within biofilms resistance to antimicrobials and host defenses. The most frequent causative agents of nosocomial CAUTI derive from the patient's colonic flora or from the hands of health care personnel. E. coli is the most common organism, 80-85% of cases. Pseudomonas aeruginosa accounted for one quarter of all CAUTIs.

Urine sampling:
Apply aseptic technique when collection of urine sampling. Urinalysis should not be routinely performed on long–term indwelling urinary catheter, as virtually all patients have bacteria present in their urine. Indications for urine sampling include: patient is systemically unwell, patient has fever and lack of response to treatment.

Methods for collection of urine sampling: fresh catheter urine and indwelling catheter urine. For the fresh catheter urine, change a new Foley
catheter to avoid culturing colonizing bacteria. For indwelling catheter urine, disinfect the sampling port or distal end of the urinary catheter with 70% alcohol for at least 30 seconds for the disinfectant to dry before puncture. Then aspirate the urine carefully to prevent needlestick injury[8]. Changing the catheter if indwelling urinary catheter keep more than 7 days or cloudy or smelly urine is evidenced. Remember never puncture silicone urinary catheters with a needle as it cannot reseal over the puncture holes[9].

Prevention of CAUTIs:
CAUTIs are one of the most common HAI. Therefore, healthcare professionals place great emphasis on prevention. Prevention of CAUTI is hindered by the numbers and types of organisms present in the periurethral area as well as by the typically longer duration of catheter placement. Studies reported pyuria was a poor marker for CAUTI in catheterized patient and that it should not be used to determine the need for antibiotic treatment[10].
Antimicrobial agents in general have not been effective in preventing CAUTI in persons with long-term indwelling urinary catheters. Moreover, routine antibiotics for asymptomatic catheter-associated bacteria is

not recommended as it promotes antimicrocial resistance[11]. Preventive strategies that avoid the use of antimicrobial agents may be necessary. A bundling strategy can reduce significantly the incidence of CAUTI as well as the use of urinary catheter days. The bundle strategy focus on five aspects[12]:

1) *Avoid unnecessary urinary catheterization*
   - Minimize indwelling urinary catheter use and consider alternatives method. The rate of bacteriuria and UTI are lower with suprapubic catheterization and intermittent catheterization than with indwelling urethral catheter[13].
   - Condom catheter is appropriate for non-cognitively impaired male patients with minimal post-void residual urine
   - Avoid bladder distension. Use portable bladder scan machine to assess the urine volume[14].
   - Insert the indwelling urinary catheters only for appropriate indications.

2) *Selection of catheter –material and size*
   - Select the type and gauze of urinary catheter based on assessment of the patient's individual characteristics including age, allergy history, history of UTI, any previous history and reason for catheterization
   - Use the smallest diameter catheter allows free flow of urine. Large diameter likely to cause unnecessary pressure on the urethral mucosa, leading trauma

3) *Insertion of indwelling urinary catheter with aseptic technique[15]*
   - Ensure health care personnel, who are involved in urinary catheter insertion or care are trained and competent to perform the procedure with aseptic technique

4) *Aseptic maintenance routine*
   - Perform hand hygiene before and after manipulation of the catheter device or the collecting bag
   - Maintain a continuously closed drainage system. Only change the drainage bag when the collecting system is damaged
   - Proper securement of the urinary catheter to prevent dislodgment, tissue trauma and urethral traction
   - Maintain unobstructed urine flow and keep the catheter and drainage system free from kinking
   - The drainage system should always be kept below the bladder level to prevent reflux -The urine bag should never touch the floor
   - Using a separate clean collecting container to empty the urine bag for each patient
   - Change gloves between patients to prevent cross-infection[16]
   - Routine daily personal hygiene is required for meatal and perineal care.
   - Change the catheters according to the manufacturer's advice
   - Maintain regular bowel function to prevent constipation may cause pressure on the drainage lumen that prevents the catheter from draining adequately
   - Regular fluid intake (25-35/ml/kg/day) maintains the urinary flow and reduces the risk of infection and catheter blockage (maintain an urine output of 50-100ml/h)

5) *Daily review of the indwelling urinary catheter*
   - Clearly documentation of the days that an indwelling urinary catheter is in place, the time, the date of insertion, planned date for removal of catheters and the reasons for keeping the catheter[3]. Nurse should remind physician to remove the catheter if no longer indicated[17]. This is important for all patients, particularly important at the time of patient discharge or transfer.

Conclusion:

CAUTI is common, costly and causes significant patient morbidity. It is one of the most preventable HAI. Routine prophylactic antibiotics for indwelling urinary catheter are not recommended as it increases the risk of emergence of antimicrobial resistance bacteria[16]. Treatment of ASB accounts for excess antimicrobial use in hospitals and should be avoided. Daily risk of developing CAUTI increased by 3-7%. Duration of indwelling urinary catheterization is the predominant risk for CAUTI, preventive measures directed at limiting placement and early removal of urinary catheters have an impact on decreasing CAUTI rates.

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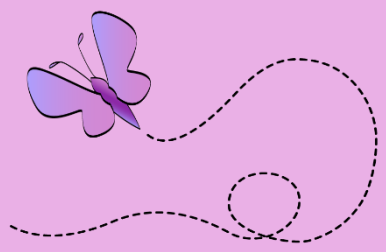

Organic cause for urinary incontinence in Children

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Introduction:
Urinary incontinence in children is a common condition we see in primary care and hospital setting. In most cases they are due to immaturity of the bladder or arousal mechanism but a portion of these children has an identifiable anatomical or neurological cause. If left undiagnosed these can have detrimental effect on renal, bowel and neurological function. This article will focus on the organic causes for urinary incontinence in children. All terminologies used in this article will follow the definitions stated by the International Children's Continence Society (ICCS)(1).

Etiology

Children with urinary incontinence will be found to have one of three aetiologies (Table 1) (2). It is vital in the initial evaluation to elicit the symptoms and signs that may point us to anatomical and neurogenic causes.

Anatomical	***Congenital*** Ectopic ureter Sphincter deficiency seen in epispadias, bladder and cloacal exstrophy (extremely rare) ***Acquired*** Iatrogenic injury to external urethral sphincter (eg. After posterior urethral valve ablation or ectopic ureterocele incision)
Neurogenic	***Congenital*** Myelodysplasia Occult spinal dysraphism Sacral agenesis ***Acquired*** Central nervous system lesions (eg. Transverse myelitis, spinal tumours, trauma) Peripheral nervous system injury (eg. Injury to sacral nerves from trauma or surgery)
Functional/hormonal	Detrusor overactivity Nocturnal polyuria

Anatomical lesions can lead to continuous incontinence, which is always an important symptom during history taking that warrant further paediatric urological specialist opinion. In females, ectopic ureters with orifice distal to the external sphincter will cause continuous incontinence (Photo 1), as do sphincter deficiency seen in children with epidspadias, bladder and cloacal exstrophy, with the later being extremely rare compare to ectopic ureter.

Ectopic ureter

By definition ectopic ureter is any ureter, single or duplex, that does not enter the trigonal area of the bladder (3). Ureter maturation occurs after the ureteric bud sprouts from mesoneophric duct in the fifth week of gestation and ectopic ureter can arise due to abnormal timing or location of this process. In a Duplex renal system, this invariably occur to the upper moiety ureter, presumably due to its budding from mesonephric duct later than the lower moiety ureteral bud. In female the ectopic ureter may enter anywhere from the bladder neck to the perineum and into the vagina, uterus, and even the rectum. In male the ectopic ureter always enters the urogenital system above the external urethral sphincter and usually into the

Wolffian structures including vas deferens, seminal vesicles, or ejaculatory ducts. This is the reason behind why we only see urinary incontinence due to ectopic ureter in female. (4)

Photo 1. This is the perineum of an 8 years girl presented to us with continuous dribbling since birth. Ultrasound of urinary system showed left Duplex kidney with an associated dilated upper moiety ureter. Examination under anaesthesia showed the left upper moiety ectopic ureter orifice between urethral and vaginal opening.

The most common neurogenic bladder dysfunction is myelodysplasia, a term used to describe various abnormalities resulting from failed fusion of the vertebral column with associated malformations in spinal cord and surrounding structures resulting in meningocele, myelomeningocele or lipomyelomeningocele. More commonly we see occult spinal dysraphsim, which are conditions such as fatty filum terminale, intramullary lipoma, syringomyelia with subtle skin defect (Photo 2). In children with myelodysplasia presented in neonatal period, 15 to 20% have an abnormal urinary tract on radiological evaluation. Their bladder dynamics can range from synergic, dyssynergic with and without poor detrusor compliance, and complete denervation. All of which have consequence on renal function and long-term quality of life. (5)

Photo 2. This is a 6 years old boy presented to us with urinary incontinence. He had a history of neonatal spinal surgery in another country and defaulted follow up until just before he attended us. On physical examination there was a scar over lumbar sacral region with a mass beneath the scar. Further imaging showed a residual lipomyelomengingocele. He was later referred to neurosurgery for assessment for repeat excision.

Evaluation and workup

A detailed history and physical examination are the cornerstones of the evaluation of a child presenting with urinary incontinence. The information that we should obtain from first consultation (Table 1) are important to provide an idea to guide us to whether any and what kind of further investigations should be done.

History
Any dry period of 6 months or more (Primary or secondary)
When (day/night/diurnal), (continuous/intermittent)
Where (only at home/at school/anywhere)
Frequency
Amount of leakage
Other lower urinary tract symptoms
Bowel habit (frequency/consistency)
Impairment in motor functions, any gait problem

Past medical history
Medical (eg. Diabetes mellitus, malignancies)
Surgical (eg. Instrumentation to urethra, abdominal or pelvic surgery)
Behavioural/Psychological (eg. Attention deficit hyperactivity, recent stressors at school or home)

Physical examination
General: gait, hydration, behavior
Abdomen: scars, palpable bladder or colon
Perineum: ectopic ureteral orifice in girls, meatal position in boys
Spine: scars, abnormal skin change/tuft of hair/birthmarks
Per rectal exam: loaded rectum, tone
Lower limb reflexes

Further investigations and management

All patients with urinary incontinence should receive non-invasive investigations as a baseline after first consultation, which include urinalysis, radiograph of lumbar sacral spine and are advised to fill in a bladder diary. If organic cause of incontinence is detected on history or physical examination, they should be referred to Paediatric Urological specialist center for further workup and management.

Further anatomical delineation of the urinary system can be done with ultrasound urinary system, looking for hydroureteronephrosis, duplicated system and bladder wall thickness. If further delineation of anatomy is needed then a micturiting cystourethrogram, magnetic resonant urography (Photo 3) or cystoscopy with or without retrograde pyelogram will be our next choice. Ultrasound spine (less than 4 months of age before ossification of verterbral column) or Magnetic resonance imaging of the spine is indicated when spinal pathology is suspected. Functional assessment of bladder dynamics can be done with uroflowmetry or urodynamic studies. Urodynamic studies, although invasive, can give vital information about capacity, detrusor pressure change during filling and voiding, which guide further management (6). Since 2013 our center has adopted a standardized protocol for ambulatory urodynamic studies for paediatric patients (7) and found it is a user-friendly method of assessing bladder dynamics. (Photo 4)

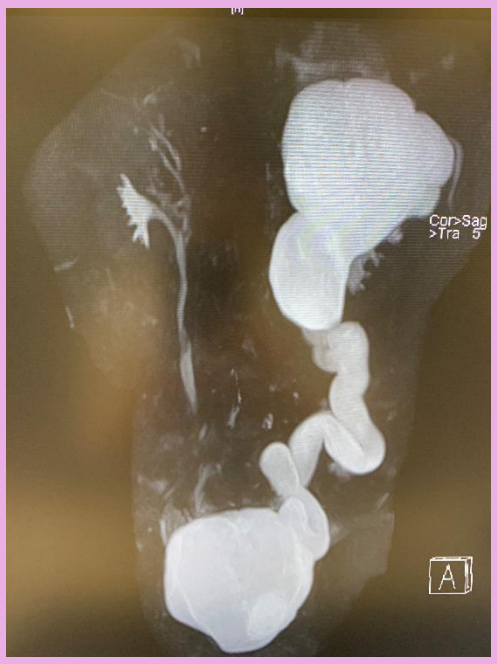


Photo 3. Magnetic resonant Urography of the patient shown in Photo 1 showing a left side Duplex kidney with massively dilated upper moiety ureter down to level below bladder neck. DMSA scan confirmed the upper moiety is non-functioning.

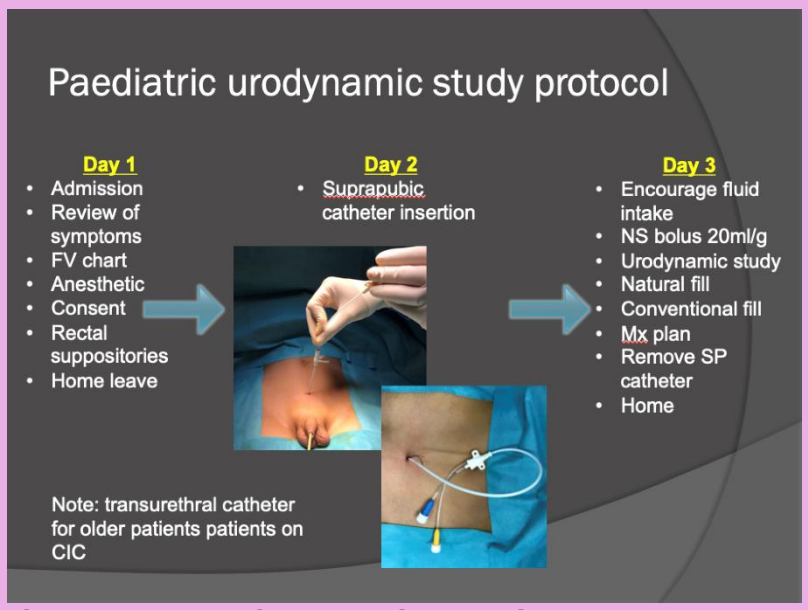
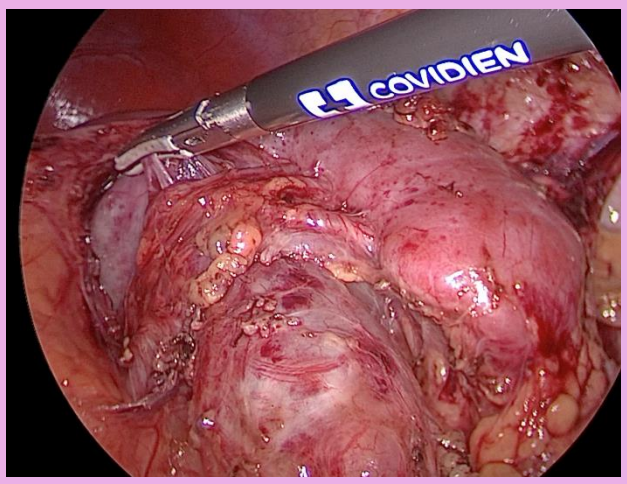


Photo 4. Current urodynamic study protocol in our center.

Management of ectopic ureter causing urinary incontinence

Once the diagnosis of ectopic ureter is confirmed, subsequent management depends on the function of the kidney (single system) or upper moiety (duplex system) the ectopic ureter is associated with, and also the condition of the ipsilateral lower moiety. For this purpose a DMSA scan and a micturiting cystourethrogram will be performed. For non-functioning kidney or upper moiety associated with an ectopic ureter, our choice of procedure is laparoscopic nephroureterectomy or laparoscopic upper pole heminephrectomy (Photo 5-7). If the upper moiety has preserved function then the procedure of choice will depend on the condition of the lower moiety. If there is no evidence of reflux to lower moiety, then we will perform a minimally invasive (laparoscopic or robotic assisted) distal ureterouretostomy. However, if there is evidence of reflux to lower moiety, then there are options of either a common sheath reimplantation or a lower moiety ureteric reimplantation with a distal upper to lower moiety ureteroureterostomy.



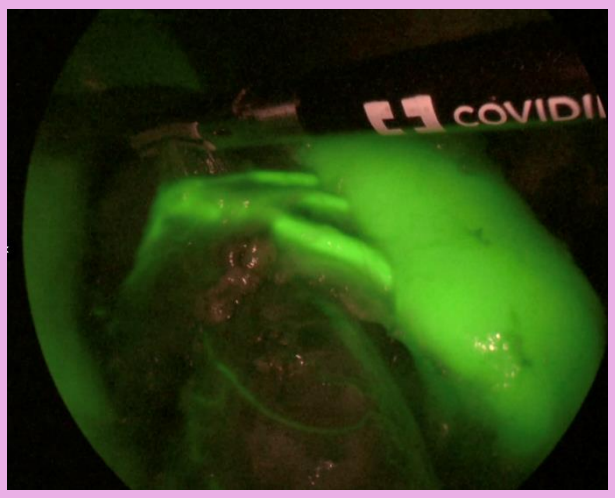


Photo 5-6. Laparoscopic upper-pole heminephrectomy for patient shown in Photo 1. After cystoscopy, retrograde pyelogram and stenting of lower moiety (LM) ureter, laparoscopic left upper hemi-nephrectomy was performed. After mobilizing and transecting the upper moiety ureter, the renal hilum was dissected and vessels to both moieties were identified. Soft clamping of UM vessels done while blood supply to the LM was confirmed with injection of ICG (total 0.5mg/kg injected). Clear visualization allowed proper safeguarding of LM vessels throughout the procedure. There was no intra-operative complication and patient was discharged on day 6 post-op. Patient had complete resolution of dribbling at 2 months post-op

Photo 7. On two months post-operative follow up, the abdominal scars at subumbilical, left upper and lower quardrant healed with satisfactory cosmesis.

Management of neurogenic bladder

The main aims of treatment in a child with neuropathic bladder are protecting the upper tract, preventing recurrent urinary tract infection and achieve social continence. The management of neurogenic bladder is more multifaceted and variable between centers. There are published guidelines (8, 9) (National Institute for Clinical Excellence, NICE 2012, European Association of Urology, EAU 2011) on the management of neuropathic bladder but they are not specific to children. In 2016 the British Association of Paediatric Urology has published a guideline specific to managing childhood neuropathic bladder. (10). Our approach is that for all patients with confirmed spinal abnormalities, a baseline ultrasound, micturiting cystourethrogram and a DMSA will be performed. Urodynamic studies will also be done before neurosurgical intervention and when there is change in clinical condition in a previously stable neuropathic child. We adopt the practice of early urodynamic studies for risk stratification so that we can closely follow

up patients with high risk of upper tract deterioration. The mainstay of medical management includes anticholinergics (oxybutynin, tolteradine and solefenacin) and clean intermittent catheterization. Early prophylactic medical treatment reduces the need for bladder augmentation procedures and preserves renal function. In 2013, the Food and Drug Agency (FDA) USA approved the use of intravesical botulinum toxin A for overactive bladder in adults but not enough evidence to suggest the use in children. Subsequent studies found that there was increase in maximal cystometric capacity, reduced maximal detrusor pressure and increase compliance. We use intravesical botulinum toxin A for patients who have high end-fill detrusor pressure and poor compliance despite anticholinergics. Once the conservative and medical options have been exhausted, surgery is the next option to protect and upper tract and achieve continence. The surgical options to increase the capacity and compliance are: the use of bowel (gastrocystoplasty, ileocystoplasty, colocystoplasty); the use of ureter (ureterocystoplasty), or autoaugentation (detrusorectomy). The commonest augmentation performed (and also our choice of method) is ileocystoplasty. Complications from augmentation include bladder calculi, bladder or bowel perforation, metabolic complications, bone demineralization, nutrition problem and risk of secondary malignancy. There has not been a consensus as to when surveillance cystoscopy starts but in general it is recommended to start 10 years after augmentation. (10)

Conclusion

Urinary incontinence is a common problem in children, with it being the presenting symptoms of underlying organic cause. A detailed assessment with a high index of suspicion is needed so that a timely diagnosis and treatment can be initiated.

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Hong Kong Continence Society AGM on 28 Sep 2019

Main theme : Management of Urinary Tract Infection

Management of uncomplicated lower Urinary tract infection by Dr. Chan Yuen Mei

Interstitial cystitis / Painful bladder syndrome by Dr. Mak Ho Leung Jimmy

Mathematical model for UTI and implication on daily management by
Dr. Tam Cheuk Kwan

Catheter associated Urinary tract infection by Ms Chung Ying Ying

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