Interventional Vaginal Sonography in Female Lower Urinary Tract Disorders

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INTRODUCTION

Minimally invasive surgical procedures are the trend in current health care. Transvaginal sonography (TVS) with a high-resolution endovaginal probe can aid in the diagnosis and treatment of female lower urinary tract disorders. Moreover, the application of real-time imaging, color Doppler mapping, power Doppler angiography, and three-dimensional (3D) technology helps in the exploration of the pathophysiology involved in female lower urinary tract disorders.

On ultrasound, the urethra appears as a tubular structure with a central echolucent area and surrounding echogenic structures (Fig. 1). The normal bladder is no more than 6 mm thick and can be divided into two layers (Fig. 2). The outer layer is more echogenic than the inner layer. In addition, the thickness of the outer layer is fixed regardless of bladder volume whereas the thickness of the inner layer varies with the degree of bladder distension [1,2]. Under normal circumstances, a non-dilated ureter is not visible [3]. The ureteric jet is clearly visible from both ureteral papillas on Doppler flow imaging (Fig. 3). Against the echogenic overlying bladder wall, a ureteral papilla is seen protruding from the bladder wall as a hypoechogenic structure. These papillae are triangular in 80% and trapezoidal in 20% of women. The average height of a papilla is 3.5 ± 0.7 mm on the right side and 3.6 ± 0.9 mm on the left [3].

Based on the morphologic characteristics displayed on ultrasound and the application of new technologies, TVS can assist in surgical intervention and aid functional and morphologic assessment of female lower urinary tract disorders. Management of female lower urinary tract disorders can therefore be done with minimally invasive techniques.

ASSISTING IN SURGICAL INTERVENTION

Urethral stricture and stenosis

Intrinsic obstructive lesions are rare in women, with urethral stricture accounting for only 13% of cases [4]. The causes of urethral stricture or stenosis in women, which may be congenital or acquired, include injury during childbirth, vaginal surgery, pelvic fracture, infection, acute or chronic inflammation, and paraurethral tumors [5].

Urethral dilation is the oldest and simplest treatment for urethral stricture. The goal is to stretch the fibrotic tissue without producing more scarring. Regardless of the instrument used, dilation ideally should be performed gradually, because overvigorous disruption of the stricture simply causes further tissue injury, allowing extravasation of urine and inflammation predisposing to more fibrosis. Hence, the stricture should be dilated only until minimal bleeding occurs. If marked bleeding occurs during dilation, the stricture has been torn rather than stretched, further injuring the involved area [6]. Blind urethral dilation, even when done cautiously with small dilators, is hazardous and carries the risk of perforating the urethra and creating a false passage. During urethral dilation procedures for total urethral stenosis [7] or urethral stricture [8], TVS is helpful in preventing urethral perforation and creation of a false passage, a possible sequela of blind dilation. Even in the presence of extensive stenosis, urethral mucosa appears as a hypoechoic area on TVS. Thus, under ultrasonographic guidance, advancing the dilator exactly through the echolucent part of the urethra ensures penetration of the dilator into the correct tissue plane [7, 8].

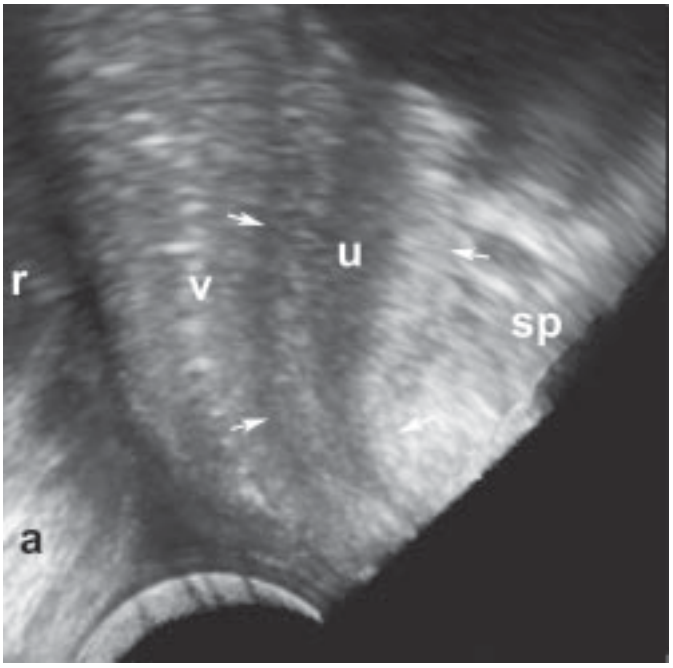

Fig. 1. TVS displaying the urethra (u) as a tubular structure with a central echolucent portion and surrounding echogenic structure (arrows). (sp: pubic symphysis; v: vagina; a: anal canal; r: rectum)

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Bladder neck obstruction due to intravesical blood clots

After a major procedure in which surgical damage to the lower urinary tract or postoperative bladder bleeding is a possibility, bladder drainage with an indwelling catheter should be instituted despite the small risk of bladder infection. Postoperative bladder care in these cases requires ensuring that the bladder is adequately drained and does not become overdistended [9]. Overdistension of a traumatized bladder may result in serious long-term voiding dysfunction and can undo the results of a technically well-executed surgical procedure. Cystoscopy may be helpful in determining the cause of blockage and evacuating clots when bladder drainage fails because of obstruction, kinking, knotting, or displacement of the catheter. However, severe hematuria may obscure the cystoscopic view and require high-flow irrigation, which carries a risk of bladder rupture [10].

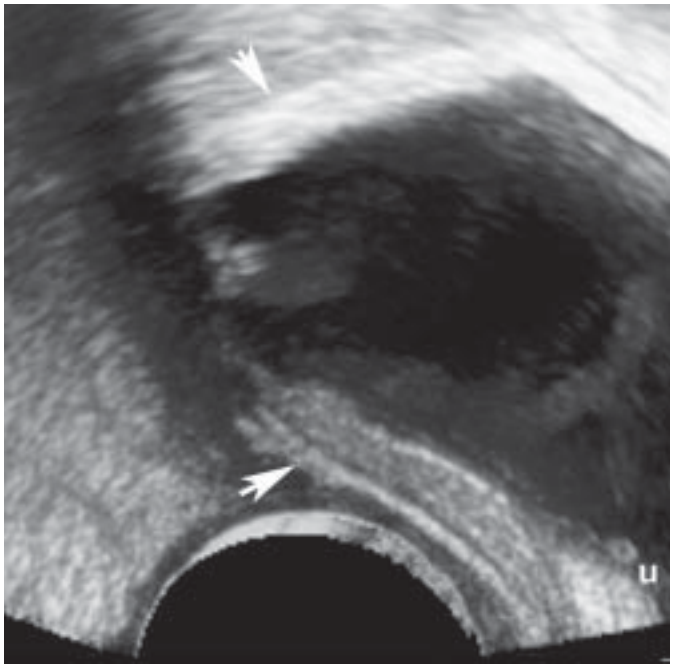

Fig. 2. TVS displaying the two-layer structure of the bladder. The outer layer (arrows) is more echogenic than the inner layer (u: urethra).

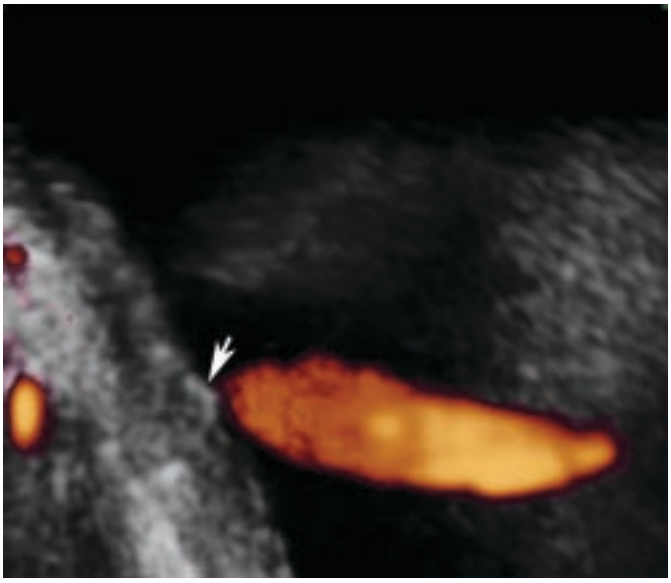

Fig. 3. Ureter jet phenomenon. Power Doppler demonstrating urinary flow emitting from the ureter papilla (arrow).

TVS has been reported to be an effective and safe tool in the treatment of acute urinary retention due to intravesical blood clots [11]. It can help in identifying and localizing clots without causing further instrumental injury to the bladder wall, which might aggravate already existing bleeding. It also can aid in estimating the irrigation volume required, which can prevent bladder overdistension. Intravesical suction and irrigation for removal of the clots may then be performed more efficiently and safely [11].

Paraurethral abnormalities

The reported incidence of urethral diverticulum varies from 0.6% to 6% in women [12-15]. Using 3D technology, the internal architecture of paraurethral abnormalities and their spatial relationship to the urethra and bladder, important considerations during surgery, are clearly demonstrated on ultrasonography [16].

Complete excision via a transvaginal approach is the most common surgical procedure, yielding a cure rate of 70% [13]. The most common complications are recurrent symptoms due to incomplete excision or development of new diverticula (in 10%-20% of cases), postoperative stress incontinence (up to 5%), and urethrovaginal fistula (up to 5%) [13]. Therefore, removal of the entire urethral diverticulum sac or subtotal excision of the sac combined with identification and closure of the ostium is crucial for symptomatic relief and prevention of recurrence [14,17]. It has been reported that recurrence of a urethral diverticulum following attempts at surgical excision leads to a more complex configuration and an increased risk of circumferential involvement [17].

Drainage of retropubic hematoma after a laparoscopic Burch operation

The advantages of laparoscopy over laparotomy include smaller incisions, decreased scar formation, quicker recovery time, and shorter hospitalization. If complications occur during laparoscopy, however, a laparotomy is often necessary, nullifying these advantages.

In a case of infected retropubic hematoma secondary to laparoscopic Burch colposuspension, the hematoma was successfully drained using laparoscopic instruments with ultrasound guidance [18]. Organizing or organized clots may cause difficult drainage. TVS can help in identifying and localizing the clots. With a 5 mm trocar as an access port to the retropubic hematoma, a high-flow suction-irrigation probe with strong hydraulic pressure enables aquadissection with disruption and complete evacuation of blood clots. Thus, postoperative drainage using a suction device with a bulb or negative-pressure design may be unnecessary.

Suprapubic cystostomy

With the combination of ultrasonography and flexible cysoscopy, percutaneous suprapubic cystostomy can be performed using a stab technique with minimal risk to the surrounding pelvic organs [19].

FUNCTIONAL AND MORPHOLOGIC ASSESSMENT

Vesicovaginal fistula

Most vesicovaginal fistulas are secondary to gynecologic surgery, with three-fourths of all fistulas occurring after abdominal hysterectomy [20]. Small, simple fistulas in the vaginal vault frequently result from unrecognized bladder injury during total abdominal or vaginal hysterectomy for benign gynecologic and obstetric disease. The treatment of a vesicovaginal fistula includes bladder drainage and surgery, depending on the site and location of the fistula. Adequate, undisturbed drainage results in closure of small posthysterectomy fistulas in 12% to 80% of cases, but the outcome is unpredictable [21]. The greatest success is achieved when a large caliber catheter is used and the fistula is only a few millimeters in diameter. The time required for healing varies from 17 days to 3 months [20]. It has been suggested that 2 months should be adequate to determine whether spontaneous closure will occur [22]. If the fistula does not close, then it must be repaired surgically, although this should be deferred until edema and inflammatory changes subside [22].

The timing of surgical intervention is most important and is best determined by periodic evaluation of the tissue [22,23]. TVS provides serial, noninvasive assessment of the condition of the bladder wall [7]. The normal bladder wall is 3 to 6 mm thick. It may become thickened secondary to chronic infection, an inflammatory reaction after surgery, or radiation. In a case of vesicovaginal fistula with conservative treatment, TVS revealed a progressive decrease in bladder wall thickness, which reached the normal range within 2 months after adequate bladder drainage, with no evidence of a persistent vesicovaginal fistula [7]. If the fistula had still been present, surgery would have been indicated at that time, because the condition of the bladder and vaginal tissue was greatly improved. Early, effective treatment of the vesicovaginal fistula minimized the social inconvenience and psychological impact of this disorder.

Distal ureteral calculi

Around 85% of ureteric stones are located in the distal ureter [24]. Calculi in this location often cause pain that radiates to the labia majora in females. Menstrual pain, pelvic inflammatory disease, and ruptured or twisted ovarian tumors may mimic the symptoms of distal ureteral stones, and a full differential diagnosis of the acute abdomen should be considered [25]. TVS provides a rapid, non-invasive and repeatable examination in the evaluation of lower abdominal pain in women [3]. It has been suggested that stones measuring less than 4 mm in diameter have a high chance of spontaneous passage, while the optimum treatment of larger stones is surgical intervention. Impaction of a ureteral stone, leading to hydroureter or hydronephrosis or both, requires drainage to prevent significant morbidity and possible mortality [25]. Therefore, imaging studies must assess these anatomical details. Renal or ureteral function may be examined non-invasively by detection of the ureter jet phenomenon using color or power Doppler flow imaging [3].

The ultrasonographic features of a distal ureteral calculus include identification of a stone within the ureter and demonstration of unilateral dilation of the collecting system [26,27]. Under normal circumstances, a non-dilated ureter is not visible [28]. It has been stated that a clearly identified ureter, seen as a hypoechogenic tubular structure, is a manifestation of hydroureter [26]. By contrast, visualization of a tubular structure in some cases may simply demonstrate the presence of ureteral edema [3,28] secondary to inflammation induced by stones. A stone may induce regional inflammatory changes resulting in the localized hypervascularity displayed on Doppler flow imaging.

In the case of ureteric stones, the goal of any imaging is to detect obstructing calculi. TVS with Doppler flow imaging helps exclude the possibility of acute obstruction. The appearance of a ureteric jet eliminates the possibility of complete obstruction. However, intervention is necessary in up to 50% of ureteric calculi greater than 5 mm [29,30]. It has been reported that the average diameter of a calculus determined by ultrasonography is significantly larger than that obtained by plain radiography. In the absence of acute obstruction and hydroureter, observation may be tried first with expectation of spontaneous passage of the stone. Although this may require as long as 40 days, it avoids the risks associated with intervention [29]. Impacted stones are those that remain unchanged in the same location for at least 2 months [31]. TVS is a repeatable, non-invasive way to look for ureteral obstruction, either on initial presentation or on follow-up [3].

Segmental dilation of a distal ureter

In primary megaureter caused by an aperistaltic segment of the distal ureter, the ureter is of normal caliber but failure of peristalsis results in functional obstruction and hence dilation of the intrinsically normal proximal ureter [32,33]. In adults it is commonly an incidental finding on urinary tract imaging, and the appearance usually remains stable over many years [34]. A smoothly tapering dilated ureter that narrows abruptly just above the ureterovesical junction is the characteristic appearance on intravenous urography. Normal peristalsis or hyperperistalsis can be demonstrated fluoroscopically and with real-time ultrasound. When extreme, primary megaureter with a ureteral diameter of 4-5 cm may cause severe obstructive hydronephrosis with parenchymal thinning and loss of renal function.

Primary megaureter is characterized sonographically by an anechoic fluid-filled fusiform or sausage-shaped structure with peristalsis [32,35]. Real-time TVS is a useful adjunct for the morphological diagnosis of primary megaureter [33,34,36]. In addition, Doppler scanning as part of TVS is helpful in assessing function; a strong ureteral jet indicates patency with powerful expulsion of urine [3,34,36]. Ultrasound also avoids radiation exposure in women who may become pregnant [34,36].

Acute urinary retention in a retroverted gravid uterus

Impaction of the retroverted gravid uterus occurs in approximately 1 in 3000 pregnancies. This condition has been described in all three trimesters but most commonly it occurs between the 10th and 16th weeks of gestation [37].

Based on sonographic findings, the pathogenesis of acute urinary retention secondary to a retroverted gravid uterus is different from that suggested in previous reports [37]. The urethra itself is not compressed or attenuated. The anteriorly and superiorly displaced cervix compresses the lower bladder and interferes with drainage into the urethra [38]. In this situation, irritability from the compressed bladder during the day probably causes urinary frequency, so that frequent micturition prevents bladder overdistension. Also, when the patient is standing, urine accumulates in the lower part of bladder, serving as a cushion to prevent its collapse, thus keeping the pathway to the internal urethral orifice patent. However, in the supine position, the upper

bladder becomes dependent, so urine collects there by gravity and the cushioning effect of the lower bladder is lost. The upper bladder may even exert pressure on the uterus, indirectly aggravating lower bladder compression. A vicious circle ensues, particularly if there has been excessive fluid intake. Eventually the lower bladder collapses and the internal urethral orifice is blocked. The collapsed portion of the bladder may be mistaken for part of the proximal urethra on sonography or external compression of the urethra on cystoscopy, leading to a misunderstanding of the mechanism of obstruction [37]. In the erect position, trying to void may be similar to trying to unplug a sink full of water. The more water in the sink, the more pressure it exerts on the plug, and the more difficult it is to pull the plug. The Valsalva maneuver merely adds further pressure on the impacted uterus, leading to further lower bladder compression. The patient may become exhausted with the effort of trying to void and require catheterization. Even though insertion of the catheter may be difficult, resistance to its passage can be overcome easily by manually lifting the cervix. Prophylactic measures for this condition have been reported [38]. Fluid limitation before going to bed limits bladder distension. Shifting from the supine to the prone position before getting up allows urine to flow from the upper to the lower bladder, relieving additional pressure on the uterus, decreasing compression on the lower bladder, and thereby reopening the collapsed area. With a Cred' e maneuver, leaning forward to begin voiding encourages urine flow into the lower bladder to distend the collapsed area and re-establish flow to the internal urethral orifice. Even though there may be significant hesitancy, once voiding begins urinary retention will be relieved.

In general, a retroverted uterus will eventually enter the abdominal cavity as gestation progresses, relieving the urinary symptoms. However, if uterine impaction persists, irreversible uterine ischemia, spontaneous or septic abortion, rupture of the uterus or bladder, rectal gangrene, or death may ensue. The persistently impacted uterine corpus, therefore, should be manually relocated to the anterior position, with or without placement of a vaginal pessary [37].

Urethral mucosa prolapse

Urethral mucosa prolapse is an uncommon condition involving the distal urethra. It occurs most often in prepubertal girls and postmenopausal women [39]. Estrogen deficiency has been postulated as a possible cause in both groups; perineal trauma and neurogenic abnormalities may also contribute [40,41]. The incidence of urethral prolapse in young girls has been reported to be 3000, but no statistics have been reported for postmenopausal women. Urethral mucosa prolapse presents as an edematous, friable mass of bright red or cyanotic tissue that can become infected, ulcerated, necrotic, or even gangrenous [41].

Urethral mucosa prolapse is usually asymptomatic in children, but it often causes significant irritation in postmenopausal women. The most common presenting complaint is bleeding from the edematous, friable mucosa [39,42]. Many possible causes of urethral mucosa prolapse have been proposed, including weak pelvic structures with poor attachment that cannot withstand increases in intraabdominal pressure [42], trauma caused by parturition, neuromuscular deficits, and estrogen deficiency [39,40]. Histopathologic changes include marked eversion of the urethral mucosa, vascular congestion in the corpus spongiosum, and cleavage between the inner longitudinal and outer circular or oblique smooth muscle layers of the urethra [41,42].

Published reports list a variety of treatment options for prolapsed urethral mucosa. In most patients, medical therapy should be tried first. However, surgery is advised in case of ineffective conservative treatment, recurrence of the prolapse, or development of complications such as mucosal necrosis. The presence of feeding arteries and draining veins in the prolapsed urethral mucosa usually exclude the possibility of necrosis and gangrene, thus allowing medical treatment to be tried first [40]. Regression in size of the urethral mucosal mass along with a decrease in urethral vascularity reflects progressive healing of the urethral mucosa prolapse. Although ultrasound may not be needed in the diagnosis and management of most cases of urethral mucosa prolapse, gray-scale and color Doppler sonography are helpful ancillary examinations in the management of this condition.

Complete obliteration of the urethra by an infiltrating metastatic tumor

In a case of voiding difficulty and acute urinary retention secondary to an infiltrating metastatic tumor, 3D axial views showed that the distal urethra was completely occluded, with the infiltrating tumor appearing as poorly demarcated echogenic streaks in the normally anechoic portion [43]. The infiltrating tumor penetrated the area between the anterior vaginal wall and urethra and destroyed and distorted the distal and lower-mid portions of the urethra. Once complete obliteration of the distal urethra by a tumor was shown, suprapubic cystostomy was the appropriate treatment. Further studies were unnecessary, however, because the ultrasonographic examination was sufficient to establish the cause of the patient's urinary retention. It was also obvious that procedures such as urethral dilatation, internal urethrotomy, and urethral reconstruction would have been of no benefit.

Bladder wall invasion by cervical cancer

The treatment of cervical cancer is based on clinical staging of the disease and the patient's performance status. Although localized disease can usually be accurately diagnosed clinically, there are still discrepancies between the clinical and surgical staging of cervical cancer, which reportedly differs in approximately 25% of early stage lesions and in 65%-90% of advanced tumors [44]. If previously unsuspected bladder wall involvement is found during radical hysterectomy, surgery is usually either discontinued early in the procedure or converted to an even more extensive operation than originally planned. The latter choice increases the risk of complications associated with the operation, such as incidental cystotomy or vesicovaginal fistula. Additionally, postoperative adjuvant radiotherapy or chemotherapy (or both) is usually required because of inadequate margins or risk factors for distant metastasis. Cystoscopy is the approved method for assessing involvement of the bladder according to the International Federation of Gynecology and Obstetrics (FIGO). However, it has only a limited role in the evaluation of infiltration or invasion of the bladder wall [44].

TVS provides a relatively clear demonstration of the tissue planes between the cervix and lower urinary tract [2,45]. Four stages of bladder invasion have been defined based on morphological changes in the bladder wall on ultrasonography [2]: stage I, disruption of the endopelvic fascia without any change in the thickness and morphology of the inner bladder wall; stage II, a thickened bladder wall without an abnormal surface or texture of the inner bladder wall; stage III, a thickened bladder wall with an abnormal surface and texture of the

inner wall; and stage IV, complete disruption of the bladder wall with loss of normal texture and architecture of the inner wall. It has been reported that cystoscopy does not reveal any abnormality of the bladder mucosa in stage I or II bladder wall invasion [45].

As yet, ultrasonography has not been investigated as part of the clinical staging process for cervical carcinoma. We believe the time has come for these studies to be done. In the meantime, we recommend the use of this diagnostic tool as a means of exploring tumor behavior and planning treatment for cervical cancer.

CONCLUSIONS

In addition to its diagnostic role, TVS may offer another option in the management of female lower urinary tract disorders. It can assist in surgical intervention and aid in functional and morphologic assessment. With more information available, management of female lower urinary tract disorders can be done using minimally invasive techniques and invasive or unnecessary procedures can be avoided.

REFERENCES

1. Yang JM, Huang WC: Bladder wall thickness on ultrasonographic cystourethrography. Affecting factors and their implications. J Ultrasound Med 2003; **22**:777-782.
2. Huang WC, Yang JM, Yang YC, Yang SH: Ultrasonographic characteristics and cystoscopic correlates of bladder wall invasion by endophytic cervical cancer. Ultrasound Obstet Gynecol 2006; **27**: 680-686.
3. Yang JM, Yang SH, Huang WC: Transvaginal sonography in the assessment of distal ureteral calculi. Ultrasound Obstet Gynecol 2005; **26**:658-662.
4. Haylen BT: Voiding difficulty in women. Int Urogyencol J Pelvic Floor Dysfunct 2000; **11**:1-3.
5. Jordan GH, Schlosberg SM, Devine CJ: Surgery of the penis and urethra. In: Walsh PC, Retik AB, eds. Campbell's Urology. 7th ed. Philadelphia, PA: WB Saunders Co, 1998, pp 3316-3394.
6. McAninch JW: Disorders of the penis and male urethra. In: Tanagho EA, McAnich JW, eds. Smith's General Urology. 15th ed. New York, NY: McGraw-Hill Book Co, 2000, pp 661-675.
7. Huang WC, Yang JM: Transvaginal sonography in the treatment of a rare case of total urethral stenosis with a vesicovaginal fistula. J Ultrasound Med 2002; **21**:463-467.
8. Huang WC, Yang JM: Transvaginal sonographic findings in diagnosis and treatment of urethral stricture. J Ultrasound Med 2003; **22**:1405-1408.
9. Wall LL: Urinary stress incontinence. In: Rock JA, Thompson JD, eds. TeLinde's Operative Gynecology. 8th ed. Philadelphia, PA: Lippincott-Raven, 1997, pp 1087-1134.
10. Smith DP, Goldman SM, Fishman EK: Rupture of the urinary bladder following cystoscopic clot evacuation: Report of two cases diagnosed by CT. Abdom Imaging 1994; **19**:177-179.
11. Yang JM, Huang WC: Transvaginal sonography in the treatment of acute urinary retention due to intravesical blood clots. J Ultrasound Med 2003; **22**:851-854.
12. Dmochowski R: Urethral diverticula: Evolving diagnostics and improved surgical management. Curr Urol Rep 2001; **2**:373-378.
13. Bennett SJ: Urethral diverticula. Eur J Obstet Gynecol Reprod Biol 2000; **89**:135-139.
14. Fortunato P, Schettini M, Gallucci M: Diagnosis and therapy of the female urethral diverticula. Int Urogynecol J Pelvic Floor Dysfunct 2001; **12**:51-57.
15. Gerrard ER Jr, Lloyd LK, Kubricht WS, Kolettis PN: Transvaginal ultrasound for the diagnosis of urethral diverticulum. J Urol 2003; **169**:1395-1397.
16. Yang JM, Huang WC, Yang SH: Transvaginal sonography in the diagnosis, management and follow-up of complex paraurethral abnormalities. Ultrasound Obstet Gynecol 2005; **25**:302-306.
17. Rovner ES, Wein AJ: Diagnosis and reconstruction of the dorsal or circumferential urethral diverticulum. J Urol 2003; **170**:82-86.
18. Yang JM, Huang WC: Ultrasound-guided and laparoscopic instrument-assisted drainage of retropubic hematoma secondary to laparoscopic Burch colposuspension. J Gynecol Surg 2003; **19**:161-165.
19. Lawrentschuk N, Lee D, Marriott P, Russell JM: Suprapubic stab cystostomy: A safer techinique. Urology 2003; **62**:932-934.
20. Thompson JD: Vesicovaginal fistula. In: Thompson JD, Rock JA, eds. Te Linde's Operative Gynecology. 8th ed. Philadelphia, PA: Lippincott-Raven, 1997, pp 1175-1205.
21. Elkins T, Thompson JR: Lower urinary tract fistula. In: Walters MD, Karram MM, eds. Urogynecology and Reconstructive Pelvic Surgery. 2nd ed. St Louis, MO: Mosby, 1999, pp 355-366.
22. Wall LL, Norton PA, DeLancey JOL, et al: Urinary tract injury in gynecologic surgery. In: Practical Urogynecology. Baltimore, MD: Williams & Wilkins, 1993, pp 332-350.
23. Kursh ED: Etiology, evaluation, preoperative management, and endoscopic management of vesicovaginal fistula. In: Kursh ED, McGuire EJ, eds. Female Urology. Philadelphia, PA: JB Lippincott Co, 1994, pp 359-367.
24. Yaqoob J, Usman MU, Bari V, Munir K, Mosharaf F: Unenhanced helical CT of ureterolithiasis: Incidence of secondary urinary tract findings. J Pak Med Assoc 2004; **54**:2-5.
25. Stoller M, Bolton DM: Urinary stone disease. In: Smith's General Urology, 15th edn, Tanagho EA, McAninch JW, eds. McGraw-Hill: New York, 2000, pp 291-320.
26. Laing FC, Benson CB, DiSalvo DN, Brown DL, Frates MC, Loughlin KR: Distal ureteral calculi: Detection with vaginal US. Radiology 1994; **192**:545-548.
27. Hertzberg BS, Kliewer MA, Paulson EK, Carrol BA: Distal ureteral calculi: Detection with transperineal sonography. AJR Am J Roentgenol 1994; **163**:1151-1153.
28. Saita H, Matsukawa M, Fukushima H, Ohyama C, Nagata Y: Ultrasound diagnosis of ureteral stones: Its usefulness with subsequent excretory urography. J Urol 1988; **140**:28-31.
29. Miller OF, Kane CJ: Time to stone passage for observed ureteral calculi: A guide for patient education. J Urol 1999; **162**:688-690.
30. Boulier JA, Laguna P, Parra RP : Treatment options for distal ureteral stones. Arch Esp Urol 1997; **50**:208-213.
31. Lotan Y, Gettman MT, Roehrborn CG, Cadeddu JA, Pearle MS: Management of ureteral calculi: A cost comparison and decision making analysis. J Urol 2002; **167**:1621-1629.
32. Summaria V, Minordi LM, Canade A, Speca S: Megaureter and ureteral valves. Rays 2002; **27**:89-91.
33. Hertzberg BS, Kliewer MA, Leder RA, Carroll BA: Primary megaureter mimicking hydrosalpinx on ultrasonography. J Ultrasound Med 1997; **16**:441-444.
34. Talner LB, O'Reilly PH, Roy C: Urinary obstruction. In: Clinical Urography, 2nd edn, Pollack HM, McClennan BL, eds. WB Saunders: Philadelphia, 2000, pp 1846-1966.
35. Pfister RC, McLaughlin AP 3rd, Leadbetter WF: Radiological evaluation of primary megaureter. The aperistaltic distal ureteral segment. Radiology 1971; **99**:503-510.
36. Yang JM, Yang SH, Hsu HC, Huang WC: Transvaginal sonography in the morphological and functional assessment of segmental dilation of the distal ureter. Ultrasound Obstet Gynecol 2006; **27**:449-451.
37. Yohannes P, Schaefer J: Urinary retention during the second trimester of pregnancy: rare cause. Urology 2002; **59**:946.

38. Yang JM, Huang WC: Sonographic findings in acute urinary retention secondary to retroverted gravid uterus: Pathophysiology and preventive measures. Ultrasound Obstet Gynecol 2004; **23**:490-495.
39. Richardson DA, Hajj SN, Herbst AL: Medical treatment of urethral prolapse in children. Obstet Gyncol 1982; **59**:69-74.
40. Yang JM, Huang WC: Perineal sonographic findings of urethral mucosa prolapse. J Clin Ultrasound 2004; **32**:261-263.
41. Rudin JE, Geldt VG, Alecseev EB: Prolapse of urethral mucosa in white female children: Experience with 58 cases. J Pediatr Surg 1997; **32**:423-425.
42. Valerie E, Gilchrist BF, Frischer J, Scriven R, Klotz DH, Ramenofsky ML: Diagnosis and treatment of urethral prolapse in children. Urology 1999; **54**:1082-1084.
43. Huang WC, Yang SH, Yang JM: Two- and 3-dimensional ultrasonography in acute urinary retention due to distal urethral obstruction by infiltrating metastatic colon cancer. J Ultrasound Med 2007; **26**:255-259.
44. Bipat S, Glas AS, van der Velden J, Zwinderman AH, Bossuyt PM, Stoker J: Computed tomography and magnetic resonance imaging in staging of uterine cervical carcinoma: A systematic review. Gynecol Oncol 2003; **91**:59-66.
45. Huang WC, Yang JM: Three-dimensional ultrasonographic findings in bladder cancer. Ultrasound Obstet Gynecol 2005; **25**:90-94.

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時　間	課　程	講　師
14:00-14:10	Opening	陳志碩
座　長	黃俊雄、陳志碩	
14:10-14:40	Case oriented simple method for teaching about voiding disorders (LUTS/BPH)	江博暉
14:40-15:10	Rational treatment strategies for LUTS/BPH	吳東霖
15:10-15:40	Selecting an appropriate α-blocker and dosing in the treatment of BPH/ LUTS	吳文正
15:40-16:10	Should I prescribe the anti-muscarinics in the treatment of LUTS/BPH, and what's the appropriate timing	林登龍
16:10-16:30	Coffee Break	
16:30-17:00	5 α-reductase inhibitors: Single or combined therapy in the treatment of BPH/LUTS	楊啓瑞
17:00-17:30	Phytotherapy, desmopressin and other alternative treatment for BPH/LUTS	劉詩彬
17:30-18:00	Panels discussion and audience challenge	陳志碩

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