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Ultrasonography as a Screening Tool for Paravaginal Defects in Women with Stress Incontinence: A Pilot Study

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Abstract: The aim of the study was to determine whether transabdominal ultrasonography can accurately identify paravaginal defects associated with genuine stress urinary incontinence. Sixteen women were diagnosed with genuine stress urinary incontinence (GSUI) following clinical evaluation, urethroscopy and urodynamic studies. They were then evaluated by transabdominal sonography and a full bladder and immediately following micturition. The ultrasound studies were also carried out in 8 women (5 nulliparous and 3 primiparous) who had no signs or symptoms of urinary incontinence. Paravaginal defects were detected in the 16 women with GSUI: 9 had unilateral defects and 7 had bilateral defects. Only right-sided defects were identified in women with unilateral lesions. Paravaginal defects were confirmed in all symptomatic women at the time of surgery, and corresponded with the defects identified with transabdominal ultrasound. Mild unilateral paravaginal defects were identified in 2 continent parous women. Five nulliparous women and 1 primiparous control had no ultrasound evidence of paravaginal defects. A transabdominal, transverse, suprapubic ultrasound scan with a full bladder is a promising screening technique for the diagnosis of paravaginal defect in women with GSUI. Transabdominal suprapubic longitudinal sections are not useful for the identification of paravaginal defects.

Keywords: Operative laparoscopy; Paravaginal defects; Pelvic floor relaxation; Pelvic ultrasound; Stress urinary incontinence

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Introduction

The vagina is normally attached to the symphysis pubis and the pubic bones anteriorly. Laterally the vagina attaches to the white line of the pelvic fascia and the spine of the ischium, and is supported above and behind by close attachments to the bladder and uterus. However, because the uterus and bladder are movable these are not important as support structures: the real support for the vagina comes from its lateral attachments, and especially from the fibers that radiate out from the ischial spines to the anterior and posterior surfaces of the vagina. Loss of anterior pubic and, especially lateral white line and ischial spine support, which can occur during labor and vaginal delivery, will result in cystourethrocele or cystocele formation. These defects predispose women to stress urinary incontinence (SUI).

Over the years ultrasound has proved to be an invaluable diagnostic technique in obstetrics and gynecology. However, its use in the evaluation of women with incontinence associated with paravaginal defects has received very little attention [1]. A MEDLINE and ACOGNET search identified only one study [1], which seems to be the first in which contrast ultrasound was used to evaluate paravaginal defects in women with stress urinary incontinence. There is more extensive literature regarding the use of ultrasound for evaluation of the bladder neck in women with stress incontinence [2–18]. A few authors [19–22] have suggested that paravaginal defects may be responsible for stress incontinence in some women.

Our experience and that of others indicates that some women with severe pelvic organ prolapse and paravaginal defects are continent, presumably owing to bladder neck and urethral obstruction produced by marked anterior vaginal prolapse [1,19,20]. However, our experience suggests that most women with marked organ prolapse secondary to loss of vaginal support experience some degree of SUI [23–26].

We performed transverse transabdominal ultrasonography in the suprapubic area of women with genuine stress urinary incontinence (GSUI) and in asymptomatic controls. Our objective was to determine whether transabdominal ultrasonography accurately identified paravaginal defects in women with (GSUI) who had otherwise normal transurethral pressures.

This report is part of a larger comparative study in progress designed to evaluate contrast versus non-contrast ultrasonography for the evaluation of paravaginal defects.

Materials and Methods

We conducted a prospective cohort study for the evaluation of transabdominal ultrasound as a method to diagnose paravaginal defects in women with genuine stress urinary incontinence (GSUI). We selected two groups of women for evaluation: 16 consecutive patients who had clinical and laboratory evidence of stress incontinence constituted the study group, and 5 who had never delivered vaginally and 3 who had had one vaginal delivery, none of whom had signs or symptoms of urinary incontinence or clinical evidence of prolapse, served as normal controls. All patients gave informed consent to be tested.

Besides a detailed history and physical examination symptomatic patients were asked to keep a urolog where they recorded the episodes of incontinence and the conditions under which they experienced urinary loss. They also were asked to report whether they had frequency, urgency or dysuria associated with the loss. Office evaluation included the collection of catheterized urine for urinalysis, culture and sensitivity, postvoid residual urine measurements, Q-tip test for urethral hypermobility, cystometrics, urethral profilometry and urethrocystoscopy.

The patients selected for ultrasound evaluation had been diagnosed as having genuine stress urinary incontinence (GSUI) following the series of tests that included urethrocystoscopy, urethral profilometry, demonstration of urethral hypermobility by a positive Q-tip test, and a cough stress test (CST) with a negative preceding cystometrogram (CMG). Patients underwent the cough stress test in the standing position with a symptomatically full bladder immediately after cystometry. If the patient had urethral hypermobility as demonstrated by a positive Q-tip test, a negative cystometrogram, and urine loss with the cough stress test or with the Valsalva maneuver, the stress test was considered positive.

The diagnosis of GSUI was established by observed loss of urine with coughing during multichannel urodynamic studies that included simultaneous intravesical, intraurethral and abdominal pressures (measured rectally). These determinations were obtained with the use of 7 Fr Millar microtip catheters (Millar Surgical Instruments, Houston, TX, USA). The data were recorded and analyzed with an Endotek Ultra system (Surgitek, Racine, WI, USA). A cough urethral pressure profile (Surgitek Urethral Profilometer, Racine, WI, USA) was also performed in these patients by withdrawing a transurethral catheter at a speed of 0.5 mm/s with the patient coughing repeatedly and the transducer oriented at either the 3 or the 9 o'clock position. If any positive area remained under the urethral pressure profile curve with coughing, the test was considered negative. If urethral pressure equalization occurred with each cough throughout the length of the urethra, the test was then considered positive.

We diagnosed paravaginal defects clinically by temporarily reducing the cystourethrocele and minimizing incontinence after placing straight ring forceps bilaterally at the lateral aspects of the middle third portion of the vagina and gently elevating the anterior vaginal wall [1]. Because this test is not objective and is incapable of reliably distinguishing between unilateral and bilateral paravaginal defects, we postulated that transabdominal ultrasound might be able to demonstrate objectively whether unilateral or bilateral defects were present, and to distinguish between them. We therefore performed a transabdominal pelvic ultrasound with an Acuson 128 XP Computed Sonography System (Acuson Corporation, Mountain View, CA, USA) with a full bladder in order to evaluate the paravaginal spaces (Figs 1–4). We repeated the study immediately after the patient had voided. Similar ultrasound tests were performed in asymptomatic controls (Figs 5, 6).

The ultrasound examination was done with a 3.5 MHz curve transducer with the patient lying supine. The sonographer was aware of the continence status of the patients. The ultrasound studies were scheduled after the physical examination, laboratory studies and urodynamic studies had been completed.

A laparoscopic paravaginal repair [1,22,26] was performed on patients with GSUI. In order to re-evaluate

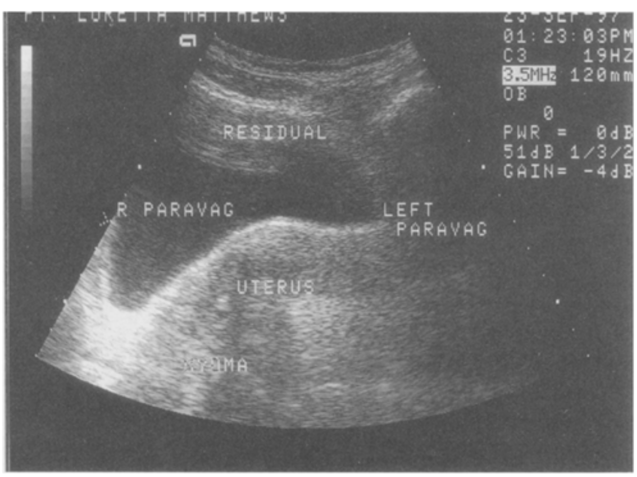

Fig. 1. Transverse suprapubic ultrasound view of patient with full bladder and with a unilateral right-sided paravaginal defect.

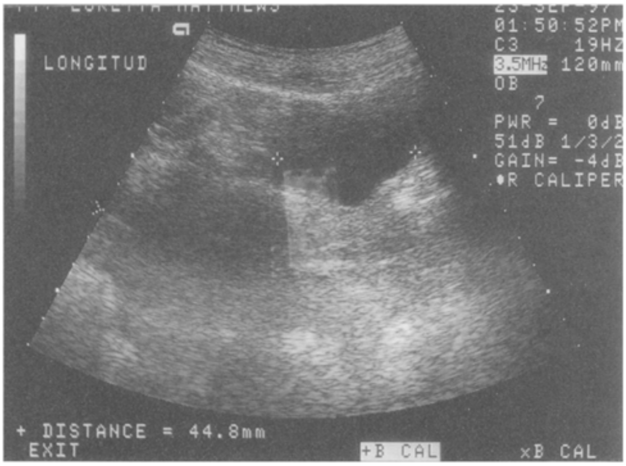

Fig. 2. Longitudinal suprapubic ultrasound view of the same patient as in Fig. 1.

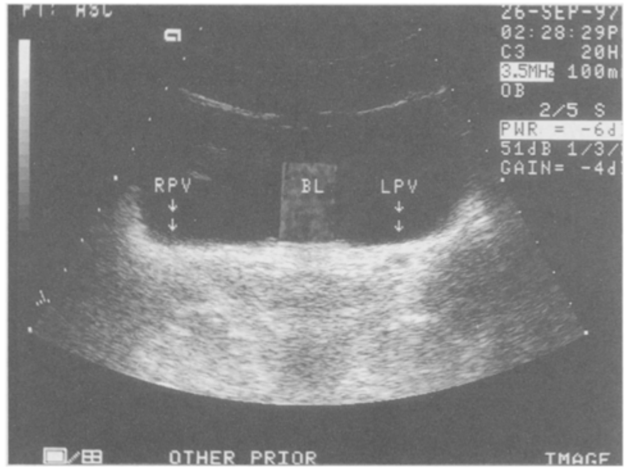

Fig. 5. Transverse suprapubic view of patient with full bladder and without ultrasound evidence of paravaginal defects.

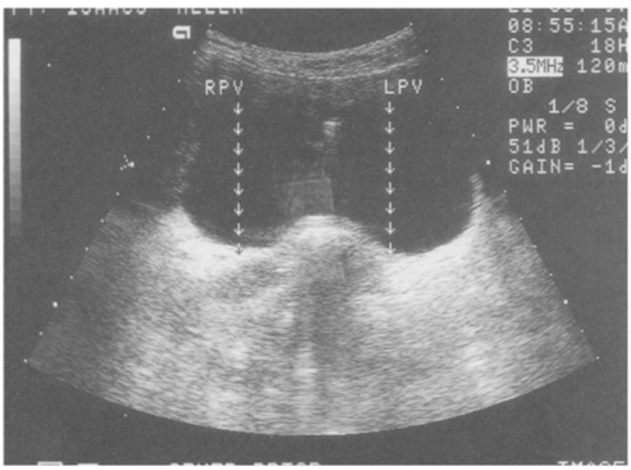

Fig. 3. Transverse suprapubic ultrasound view of patient with full bladder and with bilateral paravaginal defects.

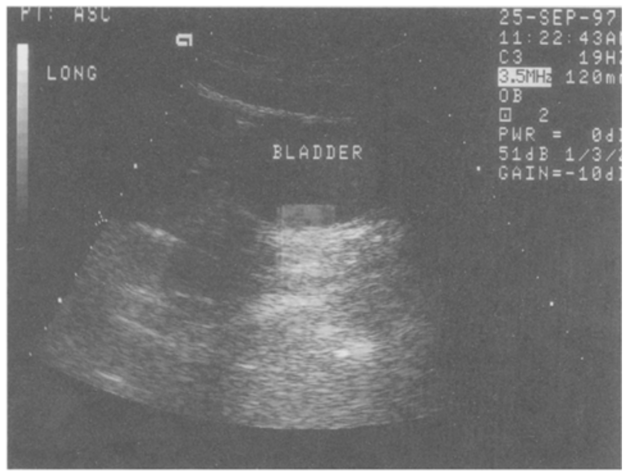

Fig. 6. Longitudinal suprapubic view of the same patient as in Fig. 5.

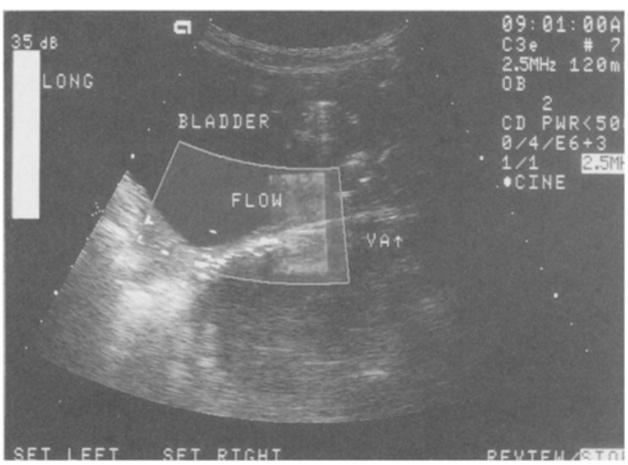

Fig. 4. Longitudinal suprapubic ultrasound view of the same patient as in Fig. 3.

the integrity of the paravaginal support, patients underwent repeat transabdominal ultrasonography and contrast ultrasonography [22] 1 week, 1 month, and 6 months after surgery.

Results

We were able to identify paravaginal defects in 16 symptomatic patients and 2 asymptomatic controls by transverse scanning and suprapubic area of patients with a full bladder. We were unable to detect paravaginal defects by longitudinal application of the transducer. Although our study was not designed to determine whether there is a defect size that is a predictor of SUI, we could classify paravaginal defects as mild or severe depending on the degree of deficit observed with transverse scanning of the suprapubic area in patients with a full bladder. In general, larger defects were associated with greater degrees of stress incontinence.

Table 1. Paravaginal defects: ultrasound diagnosis

	No defects	Left unilateral	Right unilateral	Bilateral
G_0 Controls (5)*	5	0	0	0
G_1 Controls (3)†	1	0	2	0
GSUI (6)	0	0	9	7

*Nulliparous controls.
†Primiparous controls.

Nine symptomatic and 2 control patients had unilateral right-sided paravaginal defects; 7 symptomatic and no controls had bilateral paravaginal defects. No patients were found with unilateral left-sided paravaginal defects (Table 1). Besides being unilateral, the paravaginal defects in the 2 asymptomatic patients were among the mildest observed. Furthermore, unlike the asymptomatic patients, all symptomatic patients had hypermobility of the bladder neck.

Paravaginal defects were confirmed during laparoscopic surgery in all symptomatic patients. The defects identified during laparoscopy corresponded to those identified during transabdominal ultrasonography in all cases. In other words, ultrasonography was 100% accurate in detecting paravaginal defects in patients who had GSUI secondary to loss of pelvic floor support. Postoperative scans confirmed excellent repair of the defects on follow-up scans [1].

Discussion

For many years, most gynecologists and urologists have accepted the concept that female stress urinary incontinence results from hypermobility of the bladder neck, from urethral wall pathology, or from a combination of both [2–18,21,27,28]. We believe that although hypermobility of the bladder neck may be an important mechanism of urinary incontinence, it is frequently a result of paravaginal defects [1].

It is obvious that not all patients with a cystocele or with uterovaginal prolapse who have paravaginal defects are incontinent. However, we are convinced that it is important to determine whether women with stress urinary incontinence have paravaginal defects. Our research supports the concept that mechanical or surgical corrections that do not address paravaginal defects in symptomatic patients are likely to fail if they are the main reason for incontinence [1,22,26].

The fact that there are asymptomatic patients with paravaginal defects suggests that there may be other factors contributing to GSUI. Although our ultrasound study was designed only to detect the presence or absence of paravaginal defects, and not defect size and its relationship to bladder neck hypermobility, it is possible that a critical defect volume or a combination of critical defect volume and loss of anterior support is necessary for GSUI to occur.

The fact that 2 of our control patients had unilateral paravaginal defects without bladder neck hypermobility suggests that the defects precede bladder neck hypermobility in patients who develop urinary incontinence. It is also of interests that all unilateral defects were on the right side. We suggested in a previous publication [1] that the rectosigmoid may to a certain degree protect the vaginal attachment to the white line of the pelvic fascia, and to the ischial spine on the left side.

As laparoscopic examination confirmed that ultrasound diagnosis of paravaginal defects was accurate in all cases, it is unlikely that knowledge of the continence status of patients biased our ultrasound observations. Nevertheless, it was difficult even with laparoscopy to evaluate the volume of paravaginal defects. It is possible that future studies with three-dimensional ultrasound will provide a means of measuring paravaginal defect volume and the relationship of paravaginal defects to urethral and bladder neck support.

We believe that a comparative study between asymptomatic and symptomatic women with paravaginal defects will elucidate whether defect volume, bladder capacity, degree of bladder neck hypermobility, and size and position of the uterus are important factors in the development of GSUI. If future studies suggest that paravaginal defects in asymptomatic women are risk factors for the subsequent development of GSUI, it may then be appropriate to recommend preventive repair in these women.

Undoubtedly, female urinary incontinence results from a complex interaction of anatomic and physiologic mechanisms. In the case of stress urinary incontinence caused by a low-pressure urethra, or of urge incontinence due to detrusor irritability, defects in the physiologic and functional integrity of the muscles themselves may contribute to their dysfunction [29–31]. However, our data suggest that when stress urinary incontinence results purely from anatomic defects of the pelvic floor, paravaginal defects play a much greater role than is generally appreciated. Our work suggests that in order to properly assess and manage incontinent patients, screening for paravaginal defects should be included in the evaluation of women with signs and symptoms of stress urinary incontinence.

Conclusions

Transabdominal, transverse two-dimensional ultrasound scanning of the full bladder can identify women with and without stress urinary incontinence who have unilateral or bilateral paravaginal defects. Longitudinal two-dimensional ultrasound sections are not suitable for the detection of paravaginal defects in continent or incontinent women.

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EDITORIAL COMMENT: This paper addresses a very important use of ultrasound in the evaluation of paravaginal defects. If ultrasound proves to be accurate and reproducible in this respect, it will greatly enhance our ability to evaluate anatomy and our accuracy of physical examination. Until now we could only rely on clinical impressions, surgical findings or expensive radiologic techniques such as CT and MRI. If ultrasound proves to be reproducible and easy to interpret, it will be a great addition to our diagnostic armamentarium. The universal correlation the authors found between the presence of ultrasound-defined paravaginal defect and genuine stress incontinence indicates that ultrasound may be a very sensitive test, but the presence of paravaginal defects in the volunteer group and the lack of a multiparous control group requires us to be very skeptical about the specificity of this diagnostic technique. The finding should be considered very preliminary, but they are certainly intriguing.