

Determining When to Sling for Mixed Urinary Incontinence

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ABSTRACT

Mixed urinary incontinence (MUI), defined as the combination of stress and urge incontinence, accounts for approximately one third of all cases of urinary incontinence in women. The condition often responds poorly when treated using either the pharmacological or surgical approach. In this review, we tried to address the prevalence, diagnostic enigma and therapeutic challenges of MUI. In recent years, the surgical trend has obviously changed from "proximal urethra support" to "mid-urethral support". Most importantly, the tension-free vaginal tape (TVT) procedure and its modifications have replaced the Burch colposuspension and have become the gold standard. We also discussed the controversies whether a sling should be used or not and the factors needed to be considered when to use slings in women with MUI. Finally, we summarized the hypothetic theories and proposed a possible therapeutic algorithm to manage this enigmatic situation.

Key words: mid-urethral sling (MUS), mixed urinary incontinence (MUI), stress urinary incontinence (SUI), tension-free vaginal tape (TVT), urodynamic stress incontinence (USI)

INTRODUCTION

Mixed urinary incontinence (MUI), defined as the combination of stress and urge incontinence, accounts for approximately 33% of all cases of incontinence in women. The condition often responds poorly to treatment, using either pharmacological or surgical [1]. There are still many controversies in MUI. In this review we discussed the diagnostic challenges, treatment modalities, adequacy of using a sling or not, and factors needed to be considered when to sling the patients with MUI.

DEFINITIONS

Lower urinary tract symptoms (LUTS)

MUI is the complaint of involuntary leakage of urine associated with urgency and may also be associated with exertion, effort, sneezing or coughing [2].

Urodynamic observations and conditions

Urodynamic stress incontinence (USI) is noted during filling cystometry, and is defined as the involuntary leakage of urine during increased abdominal pressure, in the absence of a detrusor contrac-

tion [2].

Detrusor overactivity (DO) is a urodynamic observation characterized by involuntary detrusor contractions during the filling phase which may be spontaneous or provoked. Detrusor overactivity incontinence is incontinence due to an involuntary detrusor contraction [2].

Mixed urinary incontinence (MUI) is the combination of the above conditions.

PREVALENCE OF MUI

Shaw et al conducted a cross-sectional survey of urinary incontinence in adult women attending primary care practices in the United Kingdom to assess the prevalence of urinary incontinence in a female population attending primary care and the extent of treatment seeking in relation to level of need [3]. Among 3,273 respondents, 21% reported stress urinary incontinence (SUI) only, 3.5% reported urge incontinence only and 21% reported mixed stress and urge incontinence during the preceding month (9% had moderate or severe symptoms). However, 53% of these women had not consulted any health care professional [3]. Hunskaar et al reported 17,000 respondents (among 30,000 women in household, via mailed questionnaire) had high prevalence of incontinence that increased with age [4]. Among these women, mixed symptoms dominated the spectrum [4]. It is estimated that nearly half of the female primary care attendees had experienced incontinence during the preceding month, but only a minority of them had sought help. Therefore, there remains considerable health decrement due to urinary incontinence in those not receiving help in a population with readily accessible primary health care services [3].

Mixed symptoms of urinary incontinence are very common, occurring in between 29% and 61% of cases. Most commonly 33% of women report a combination of urinary symptoms, but when investigated the actual figure of urodynamically proven mixed picture incontinence was lower at 14% [5,6]. In a study sample of 950 consecutive incontinent women at Duke University, 52% presented with mixed symptoms, while only 14% had mixed conditions, i.e. both USI and DO confirmed on urodynamic studies [7].

THE CHARACTERISTICS OF WOMEN WITH MUI

Holmgren et al described the demographic, reproductive factors, and medical history between women with MUI and pure USI [8]. They found that age, body mass index, cesarean section, local estrogen, radiation, gynecologic malignancy and history of chronic constipation were different in patients with MUI as compared with those with USI [8]. The large age differences between the women with USI and MUI should be noted; this was the reason for the need of adjustment for age in further statistical comparisons. The women with MUI had slightly

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higher body mass index than the women with USI. Cesarean delivery was more common in those with MUI which is a possible explanation of damage of bladder, either neurologically, muscularly, or mechanically, during dissection of the bladder. More women with MUI used locally applied estrogens than did the women with USI, when the total patient population was analyzed, odds ratio (OR) 1.65, 95% confidence interval (CI) 1.01-2.73. The women with MUI more often suffered from chronic constipation than did the women with USI. The frequency of cases with history of radiation because of gynecological cancer was higher in the women with mixed incontinence, but the actual numbers were small [8].

THE CHALLENGES AND DILEMMA OF MUI

The diagnosis challenges

From the history of the patients, it may be difficult to properly identify the two components of the disorder, i.e. urge and stress [9]. Lewis et al evaluated the differences between clinical parameters between women with urge-predominant MUI and those with stress-predominant MUI [10]. There were no significant differences between the groups with respect to symptom severity scores, e.g. American Urology Association (AUA) Symptom Index, Urogenital Distress Inventory (UDI-6), and Incontinence Impact Questionnaire (IIQ-7). Clinically, urge-predominant MUI patients had significantly higher pad usage, and lower maximum and average voided volumes than those with stress-predominant MUI; while stress-predominant MUI patients were more likely to have demonstrable SUI on physical examination (63% vs. 16%). An objective evaluation using the results of urodynamic investigations is therefore recommended for the women with MUI. Generally speaking, the stress component can easily be identified, whereas the urge component may consist of either DO, urethral relaxation or an uninhibited premature micturition reflex [9]. It is also important to exclude other causes of the urge symptoms, such as inflammatory diseases, infection, tumors and neurological disorders, before treatment of the urge component is addressed.

The therapeutic challenges

The optimal treatment modality for MUI remains inconclusive because of the two co-existing components, i.e. stress and urge. There are a variety of treatment modalities for USI, including physiotherapy, electrical stimulation, and continence surgery [11]. Treatment of DO with or without incontinence is aimed at improving central control using behavioral therapy or drugs that reduce the frequency and severity of detrusor contractility during filling [1]. However, the coexistence of these two pathologies makes the situation more complicated, i.e. the treatment of either condition may worsen the symptoms of the other. The result is likely to be poor response to conservative or surgical interventions [1].

The controversies whether the presence of DO affects the success rate in MUI

Previously, some researchers reported similar cure rates for the two types of incontinence. Rezapour and Ulmsten reported a long term (mean follow-up was 4 years) cure rate of 85% in MUI patients [9]. Jeffry et al reported cure rates of 89.3 % in both groups of patients [12]. Nilsson and Kuuva reported cure rates of 81% and 88%, respectively [13]. Kulseng-Hansen reported a cure rate of 81% for USI women,

while also 81% of those with severe urgency reported significant improvements postoperatively [14].

However, previously some other researchers reported different cure rates in the two types of incontinence. Laurikainen and Kiilholma reported a 97% cure rate among patients with stress, compared with 69% among those with urgency [15]. Meschia et al found a difference between the cure rates of women with pure USI (90%) and women with concomitant urgency (about 50% "significant improvement" of urgency symptoms) [16]. Paick et al had a 96% cure rate in women with SUI, compared with 78% in those with MUI [17]. Holmgren et al reported that cure rates for women with MUI were 20%-25% lower than for those with USI [8].

URODYNAMIC ASSESSMENT

Urodynamic study was specifically used to look at differences within the mixed picture of symptoms, i.e. urge-predominant MUI and stress-predominant MUI [10]. Lewis et al found that urge-predominant MUI patients were also more likely to have lower urodynamic bladder capacities and demonstrable DO (70% vs. 26%) on video urodynamics (VUDS) with contractions occurring at lower bladder volumes and with higher amplitude than those with stress-predominant MUI. Patients with stress-predominant MUI were more likely to have demonstrable stress incontinence on VUDS (100% vs. 61%) [10]. There appears to be differences in the clinical and urodynamic parameters between patients with stress predominant and urge predominant MUI. These may help to determine which component of the mixed incontinence is more problematic. This has implications for treatment. Cough stress test is more likely to produce a positive leak than the Valsalva maneuver, especially when the patients have mixed symptoms [18].

THE FACTORS THAT NEED TO BE CONSIDERED WHEN DETERMINING WHETHER SLING OR NOT

Individual patient desire and expectation

The individual desires and expectations play important roles in the decision making when treating women with MUI. The move from conservative management to surgical therapy must be individualized and patient driven. The potential of DO to persist or even worsen after surgery must be fully understood by the patients. Treatment of the patients with MUI must be individualized. The patients who suffers predominantly from urge urinary incontinence with only occasionally loss of urine on exertion differ greatly from the patients whose main symptoms are stress incontinence [19].

The predominant bother: stress or urge-predominant MUI

The results were analyzed according to the women's subjectively defined predominant bother: stress-predominant MUI, urge-predominant MUI, or stress and urge equally bother MUI. Across the groups, stress incontinence (20 minute stress test) was not different among the three groups, with cure rates of 87 and 83% of the women at 7 and 38 months, respectively. Women with stress-predominant MUI had significantly better results, evaluated by 24 hour pad test, patient satisfaction, subjective cure and objective cure, at both 7 and 38 months than those with urge-predominant MUI or equally-bothered MUI. Therefore, women with MUI who received tension-free vaginal tape (TVT) or other midurethral slings should be informed that their prognosis depends on

their predominant complaint. TVT is an appropriate treatment in patients with MUI, but women with urge-predominant MUI may have poorer results than those with stress-predominant MUI [20].

Low maximal urethral closure pressure (MUCP)

Paick et al reported that the presence of maximal urethral closure pressure (MUCP) was an independent risk factor for treatment failure of urge urinary incontinence (UUI). Decreasing MUCP was associated with an increased likelihood of treatment failure for patients with UUI (OR 0.974; 95% CI 0.950-0.998; P=0.034) [21].

The presence of preoperative DO

Paick et al reported the diagnosis of uninhibited detrusor contraction during cystometry was an independent risk factor of treatment failure for MUI. Uninhibited detrusor contraction was associated with 3.4-fold risk of treatment failure for patients with MUI (OR, 3.351; 95% CI, 1.031-10.887; P=0.044). In their study, they concluded that those with the presence of uninhibited detrusor contraction during cystometry should be considered to be at high risk of treatment failure for UUI after surgery [21]. Choe et al assessed the impact of the TVT procedure on overactive bladders (OAB) in women with SUI to determine the changes in preoperative OAB symptoms and the significance of DO in postoperative outcomes [22]. The complete resolution of all OAB symptoms based on a 3-day frequency volume chart and a validated questionnaire was demonstrated in 23.5% (31 of 132 patients). The group with DO showed significantly greater urinary leakage per 1-hour pad test, maximal detrusor pressure and detrusor pressure at maximal flow rate than the group without DO. There were no significant differences between the two groups in terms of cure rate for SUI. The group with DO had a significantly higher resolution rate than the group without DO for OAB (36.8 vs 18.1%, P=0.021). Therefore, Choe et al concluded that the TVT procedure can be performed in women with SUI and OAB including urge urinary incontinence even if the patient has DO on urodynamic study. However, patients should be fully advised of the possibility of persistent OAB symptoms and treatment for those symptoms after TVT should be considered.

Types of surgery, retropubic or transobturator

Obviously, the surgical trend has changed from "proximal urethra support" to "mid-urethral support". Most importantly, the TVT procedure and its modifications have replaced the Burch colposuspension and has become the gold standard [23]. Paick et al evaluated the outcomes after TVT, suprapubic arc (SPARC) sling, or transobturator tape (TOT) procedures in women with MUI. There were no significant differences among the three groups in terms of the cure rate for SUI (TVT, 95.8%; SPARC, 90.0%; TOT, 94.0%; P=0.625) and urge urinary incontinence (UUI) (TVT, 81.9%; SPARC, 86.4%; TOT, 82.0%; P=0.965) [21].

Poor long-term surgical success rate in MUI

Holmgren et al reported that women with USI had persistent cure rates of 85% from 2 to 8 years after the TVT procedure. Women with MUI had persistent cure rates of 60% up to 4 years postoperatively, but the cure rates then steadily declined to 30% at 4 to 8 years after surgery. The increased rates of incontinence were due to urgency symptoms. The results of this study indicated that initial good cure rates of TVT for patients with MUI did not persist after 4 years [8].

HYPOTHETIC THEORIES

Idiopathic DO and stress incontinence are challenging to treat. To date, the data are inconclusive as to whether the presence of DO adversely affects the success of the mid-urethral sling in treating women with SUI. The etiology of DO remains unknown. It has long been considered a disease of the detrusor muscle and/or nerves. However, some researchers suggested that in some women the abnormality might be in the urethra [22]. The results of some previous TVT studies showed that the cure rates of SUI were similar regardless of the presence of DO [24,25], while other researchers reported that the SUI cure rates decreased in patients with preoperative DO [15, 26]. In 1994, DeLancey proposed the Hammock hypothesis to study the structures involved in urethral support [27]. The urethra lies on a supportive layer that is composed of the endopelvic fascia and the anterior vaginal wall. This layer gains structural stability through its lateral attachment to the arcus tendineus fascia pelvis (ATFP) and levator ani muscle. Pressure from above compresses the urethra against this hammock-like supportive layer, compressing the lumen closed. The stability of the suburethral layer depends on the intact connection of the vaginal wall and endopelvic fascia to the ATFP and levator ani muscles [27]. The Hammock hypothesis merged the concepts of urethral support versus sphincter function. The Integral Theory, proposed by Petros and Ulmsten in 1990, offered a very unique concept to support mid-urethral sling procedure for correcting "stress and urge incontinence" [28, 29]. Below are the Integral Theory and two other hypothetical theories being proposed to explain the possible explanations for the enigmatic situation.

Integral Theory

This theory indicates that the consequences of SUI are the detachment of pubo-urethral ligament (PUL) supporting the urethra, weakened support of the anterior vaginal wall to the midurethra and impaired function of the pubo-coccygeal musculature (PCM) adjacent to the urethra. During increased abdominal pressure, e.g. coughing, laughing, etc., the PCM fast twitch contraction pulls forward the upper vagina tightly around the urethra with PUL. This contraction closes the urethra off and immobilizes while the levator plate (LP) and longitudinal muscles of the anus (LMA) pull the bladder down and back like to create a "zone of critical elasticity". Loss of elasticity here may cause the forward movement of the vagina to be cancelled, leaving the bladder neck in the incontinent "open position" [28,29]. The stated position of the Integral Theory is that stress and urge symptoms both arise from the same anatomic defect, a lax vagina [28]. The theory posits that the vagina has a dual role in transmitting voluntary and involuntary muscle contractions involved in the bladder neck and urethral closure as well as supporting the "hypothesized" stretch receptors in the proximal urethra and trigone" [19]. The Integral Theory leads us to consider how anatomy may also promote an OAB which further blurs the distinctions between stress and urge incontinence [19,30].

Proximal urethral funneling theory

In this theory, DO was thought to be caused by a weak urethral sphincter mechanism resulting in funneling of the proximal urethra. When intra-abdominal pressure is increased, urine enters the proximal urethra, producing sensory stimulation and resulting in a reflex bladder contraction. Based on this theory, DO appears to be secondary to

the underlying anatomical alteration rather than the primary pathology. Several researchers support the hypothesis that primary proximal urethra funneling can induce secondary DO [31]. Choe et al reported that the presence of preoperative DO did not significantly decrease the successful outcomes of surgery in women with SUI [22]. Therefore, the exact placement and tension of the TVT may be important for the resolution of urge symptoms. Patients with DO had greater rates of cure for the OAB syndrome than those without DO, i.e. the patients with DO who had symptoms resolved postoperatively [32]. These findings were supportive of the hypothesis. However, it remains clinically unclear whether the urine leak caused the DO initially or vice versa.

Pseudourge theory

The pseudourge theory explaining the coexistence of stress and urge symptoms is the misdiagnosis of urge urinary incontinence in a patient with SUI [33]. MUI does not have two separate pathological conditions, USI and DO, instead, the mixed symptoms may be due to a more severe form of SUI. This theory was presented to explain why urge symptoms may improve after anti-incontinence procedures. When

patients report sudden losses of urine associated with urgency, this condition may represent SUI combined with waiting too long to void rather than true urgency. In addition, patients may adopt behaviors of frequency as a strategy to control SUI. Such patients would be cured at a greater rate after sling surgery than those with true severe urge urinary incontinence. Some researchers found that the preoperative proportion of frequency and urge symptoms decreased significantly [34]. Women with SUI and concurrent urge incontinence had successful pubovaginal sling (PVS) outcomes at a rate comparable to that in women with simple USI [33].

THE PROPOSED THERAPY ALGORITHM

The proposed therapy algorithm, was depicted in Figure 1. Three levels of factors are needed to be considered in the decision making when treating women with MUI. The first factor is the individual's desires and expectations. The second is the individual's most bothersome and predominant symptom. The third factor is the urodynamic parameters, e.g. low MUCP, and presence of preoperative DO. Once

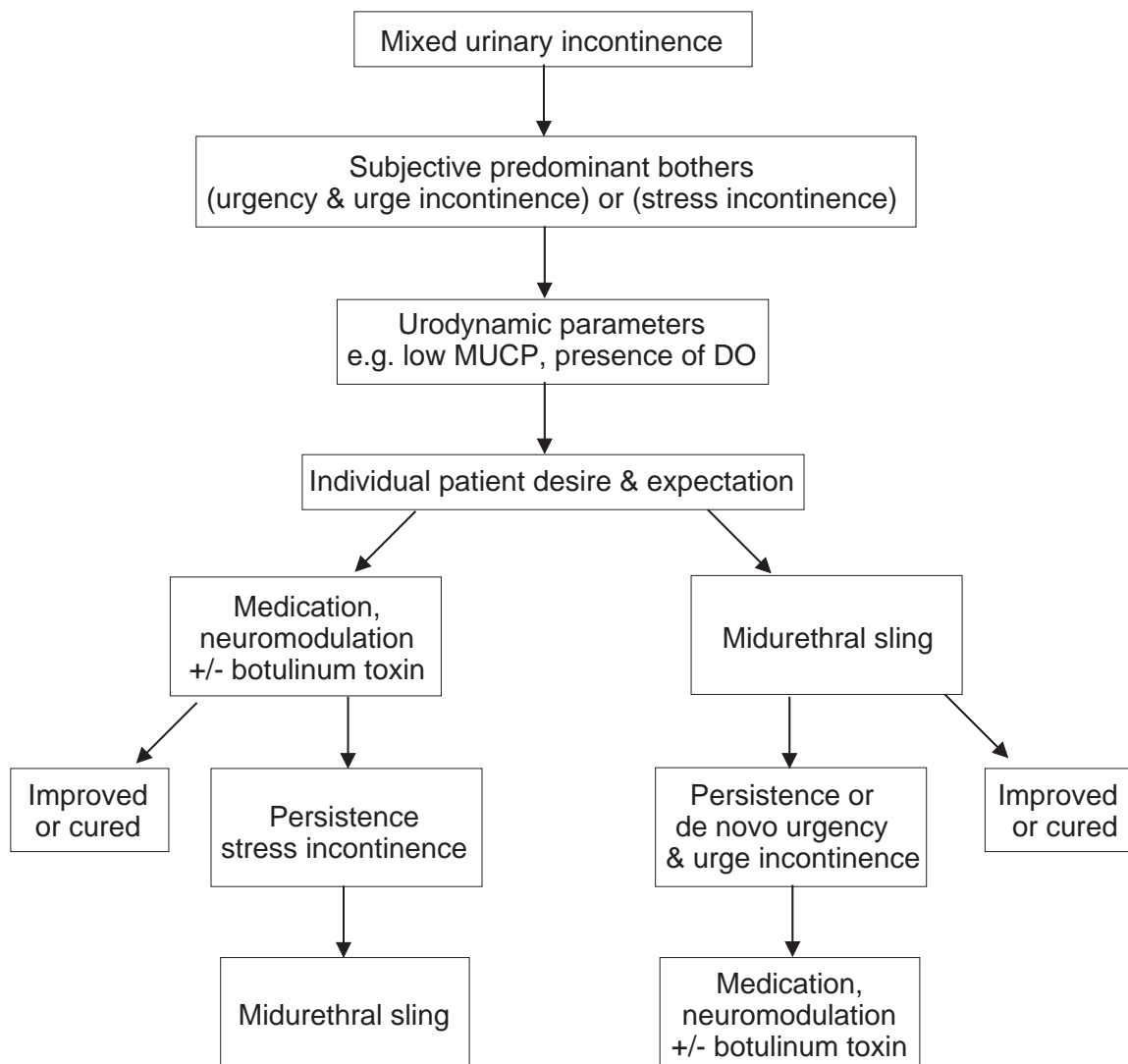


Fig. 1. Proposed therapeutic algorithm.

the patient's initial response to the primary intervention is determined, further therapies can be recommended for persistent symptoms or for secondary symptoms, should those symptoms remain problematic.

For instance, patients with mixed symptoms with a strong urge component and definable but less severe urethral sphincter dysfunction could undergo therapy specially defined to ameliorate the urgency symptoms including anticholinergic use followed by neuromodulation (and/or botulinum toxin) and a secondary intervention for the bladder outlet, should persistent stress symptoms remain bothersome. Similarly, patients with predominant stress symptoms could undergo intervention for SUI with secondary interventions for urge urinary incontinence depending upon the results of the primary intervention and persistence of bothersome urinary symptoms [5]. Alternatively, conservative or minimally invasive intervention may be initiated to establish responses, followed by more intensive intervention for the unresponsive. The patients should also be informed about which symptoms may persist or become problematic postintervention [5].

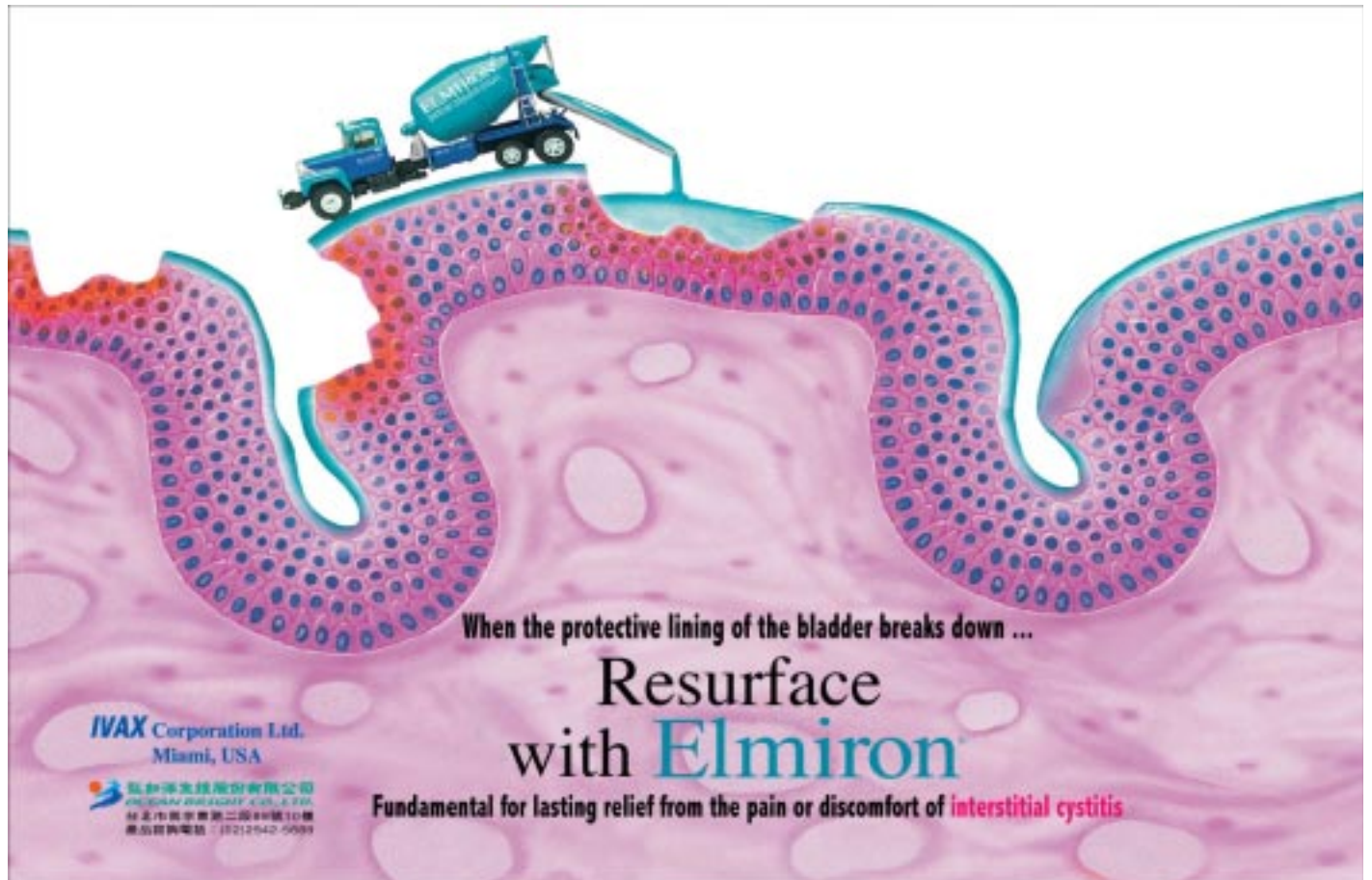
UNSOLVED PROBLEMS

There remain some unsolved problems for patients with MUI. One is how to define the cure rate when using slings in women with MUI. Another is whether to use subjective no stress or urge incontinence data, or both, or objective urodynamic study results. The question of how to identify suitable cases for sling operations and how to improve long-term surgical success rate remain. The more we know about the pathophysiology and considering factors about MUI, the more optimal treatment we can offer. These merit a more delicate and sophisticated understanding of the pathophysiology and clinical trials for women with MUI.

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