

Endoscopic Suspension of the Vesical Neck for Urinary Incontinence in Females

Report on 203 Consecutive Patients

THOMAS A. STAMEY, M.D.

*From the Department of Surgery, Division of Urology,
Stanford University School of Medicine,
Stanford, California*

The key to restoring urinary continence in the female is to raise the internal vesical neck of the bladder to a position behind the symphysis pubis. The operation which accomplishes this with the least morbidity, the most accuracy and the greatest permanency is endoscopic suspension; it is particularly applicable in patients with obesity, multiple operative failures, radiation incontinence, and severe pelvic fractures. Between December 1973 and May 1979, 203 patients underwent 211 operations with a minimum of six months of follow-up study at final review (November 1979). Twenty per cent of the patients were totally incontinent on referral, and 60 per cent lost urine with minimal activity; only 20 per cent of the patients had typical stress urinary incontinence, requiring coughing or sneezing to lose urine. Among the 203 patients, there were 188 previous operations for urinary incontinence, including 74 Marshall-Marchetti retropubic repairs. Forty-seven patients have been followed for over four years, and 156 patients have been followed for six months to four years. While 138 patients had a previous hysterectomy, 65 patients had not; the presence of the uterus did not affect the results. Urinary incontinence is not an indication for hysterectomy. Ninety-one per cent of the 203 patients were cured of their urinary incontinence by endoscopic suspension of the vesical neck. Technical advantages over the retropubic vesical neck suspensions include the use of monofilament heavy nylon (No. 2), a vaginally placed Dacron® buttress to prevent tearing of the pubocervical fascia, less postoperative morbidity, minimal blood loss, functional measurements and anatomic visualization of a restored vesical neck during the operative procedure, easy access to a surgically difficult pelvis, and simultaneous repair of significant rectoceles or substantial cystoceles through the same operative field.

THE KEY TO RESTORING urinary continence in the female is to raise the internal vesical neck of the bladder to a position behind the symphysis pubis. The operation which accomplishes this with the least

morbidity, the most accuracy and the greatest permanency is endoscopic suspension; it is particularly applicable in patients with obesity, multiple operative failures, radiation incontinence, and severe pelvic fractures.

We reported our operative technique in 1973, which was based on our first 16 patients.¹ The next 44 consecutive patients were reported in 1975;² in this 1975 report, we analyzed the anatomic changes in the position of the internal vesical neck by comparing pre- and postoperative lateral chain cystograms. The succeeding 203 consecutive patients, followed for a minimum of six months after surgery, are the subject of this report.

Methods

Surgically curable urinary incontinence (SCUI) in the female includes those women with typical stress urinary incontinence (SUI) who lose urine only with coughing, sneezing, or lifting heavy objects (Grade I), those who lose urine with minimal activity such as walking or arising from the sitting position (Grade II), and those who are totally incontinent in the upright position and who cannot hold urine in their bladders (Grade III).

Diagnosis

SCUI is not a syndrome; it is a demonstrable event which should be demonstrated on physical examination by the responsible surgeon regardless of how suggestive the history may be. Loss of urine must be shown to occur *exactly coincident* with a rise and fall in

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Reprint requests: Thomas A. Stamey, M.D., Professor of Surgery, Division of Urology, Stanford University School of Medicine, Stanford, California.

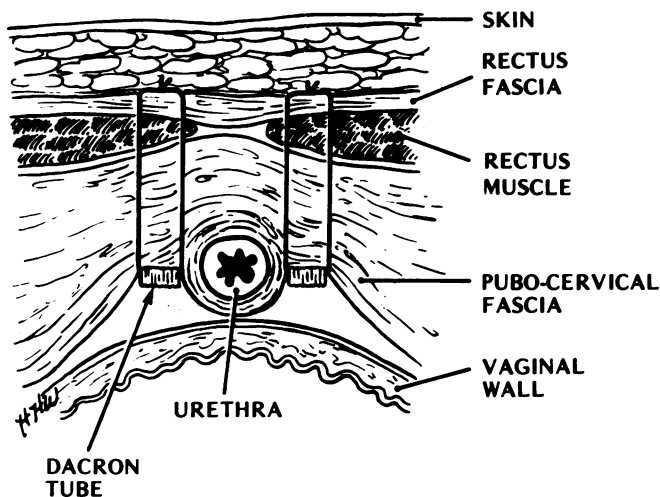


FIG. 1. Schematic illustration of the suspending nylon loops on either side of the urethra at the internal vesical neck.

abdominal pressure. The most efficient procedure is to hydrate the patient while taking her history, measure the amount of urine she voids when the bladder is full, catheterize her for a residual urine, and then fill the bladder by gravity through an open syringe to a comfortable volume of a little less than the amount she voided. The catheter is removed and the patient asked to cough while the surgeon observes the urethral meatus; loss of urine must occur coincident with the cough. If leakage of urine fails to occur in the lithotomy position, the examining table should be tilted to a 45° upright position which increases the resting bladder pressure by the weight of the intestinal contents; if urinary leakage still fails to occur, she should be examined in the standing position. If loss of urine occurs some seconds after coughing, *i.e.*, does not appear simultaneously with the rise in abdominal pressure and immediately cease with the fall in pressure, the patient has a neuropathic bladder in which the detrusor is exhibiting spontaneous contractions. In these circumstances, the patient does not have SCUI and should not be operated on.

Physical examination is completed by 1) testing the mobility of the tissues lateral to the internal vesical neck since it is these tissues that must hold the vesical neck in position behind the symphysis pubis, and 2) by determining the presence and extent of any cystocele or rectocele (I prefer a tongue depressor blade for elevating the bladder or depressing the rectum while the patient strains abdominally). A Bonney or Marshall-Marchetti test can be done in the lithotomy position during coughing to see if elevation of the internal vesical neck prevents urinary leakage, but it is always positive with SCUI and it is inappropriate for neuropathic bladders since they don't lose urine

coincident with coughing; for these reasons, its diagnostic use is obviously limited, but it is comforting to the surgeon to observe cessation of leakage with elevation of the vesical neck.

Cystoscopy, cystometrograms, and radiographs of lateral chain cystograms are unnecessary and rarely add significant information. In a very complicated case with multiple pelvic surgeries or pelvic fractures where substantial difficulty in elevating the internal vesical neck might be expected, a preoperative lateral chain cystogram can be useful. If surgery fails to correct the incontinence, the preoperative lateral chain cystogram allows the surgeon to answer the question of whether he succeeded in moving the vesical neck upward and forward behind the symphysis pubis; without movement of the internal vesical neck forward and upward from the preoperative position, there can be no cure of the urinary incontinence.

Operative Technique

The operation is performed exactly as originally described in 1973.¹ The principle of suspending the internal vesical neck on both sides by passing No. 2 monofilament nylon from the anterior rectus fascia into the vagina and buttressing the nylon vaginally by passing it through a 1 cm tube of 5 mm Dacron,[®] is diagrammatically shown in Figure 1 and further illustrated in Figure 2.

Briefly, the patient receives 80 mg of gentamicin the evening before surgery to insure a sterile urine the next day, and an additional 80 mg on call to the operating room to insure intraoperative tissue levels as prophylaxis against pelvic contamination with vaginal bacteria. With the patient in a modified lithotomy position with her legs extended laterally and knees slightly bent to insure a flat lower abdomen, two short suprapubic incisions (3–5 cm long) are made at the upper border of the symphysis pubis to the right and left of the midline (Fig. 2) and extended by blunt dissection to the anterior rectus fascia.

With a Foley catheter in the bladder, the anterior wall of the vagina is incised transversely below the urethra and the trigone of the bladder is exposed by blunt and sharp Metzenbaum dissection. Special needles (straight, 15° or 30° angled*) with an eye at the tip sufficient to thread No. 2 nylon are then passed from the anterior rectus fascia into the vaginal incision; the needle is guided exactly alongside the internal vesical neck, which is located by the balloon of the Foley catheter. The right angle cystoscope is introduced to insure that the needle has not passed through the

* Pilling Company, Delaware Drive, Fort Washington, PA 19034.

bladder and, that the needle is located exactly alongside the internal vesical neck. This latter observation is accomplished by placing the cystoscope just at the vesical neck and by observing the tissues to move up and down with the needle. Incorrect placement of the needle in the tissues toward the trigone or down the urethra distal to the vesical neck is easily determined with the cystoscope, which is the critical instrument in this operation. It is why I have called it "endoscopic suspension of the vesical neck".

The No. 2 monofilament nylon is now threaded into the needle as it protrudes into the vaginal incision and the needle is withdrawn to the suprapubic area. The needle is then passed a second time 1 cm lateral to the first medial pass, and the cystoscope used to determine exact placement outside the bladder neck. The vaginal end of the nylon suture from the first pass is then threaded through the Dacron tube and then into the eye of the needle (Fig. 2) before withdrawing the needle into the suprapubic incision, thereby establishing a complete suspending loop on one side of the internal vesical neck. The procedure is repeated on the opposite side of the vesical neck which establishes both suspending loops as seen in Figure 1.

One of the substantial advantages to this procedure is that adequate suspension of the internal vesical neck can be determined both physiologically and anatomically before tying the suspending nylon sutures. When the bladder is filled with irrigating water and the panendoscope removed, water will leak from the urethra in a large and often forceful stream, especially if the panendoscope is depressed before removal to decrease the suspending pressure of the Dacron tubes. Each suspending suture individually and both jointly can be lifted upward to determine its functional performance in cutting off the stream of water coming from the urethral meatus. The cessation of water leakage should be immediate and complete with minimal pull on the suspending sutures. Of almost equal importance, closure of the internal vesical neck can be confirmed anatomically by direct visualization of the urethra with the panendoscope by also elevating the suspending sutures in the suprapubic incision. These two measurements allow the surgeon to know that the operation should be successful. If adequate functional closure cannot be demonstrated, the suture should be replaced in a more advantageous position.

The bladder is then filled for the last time, a suprapubic percutaneous Malecot catheter passed into the bladder† (Fig. 3), the bladder emptied, the anterior vaginal incision closed with No. 00 chromic suture, and the two suspending nylon sutures tied individually

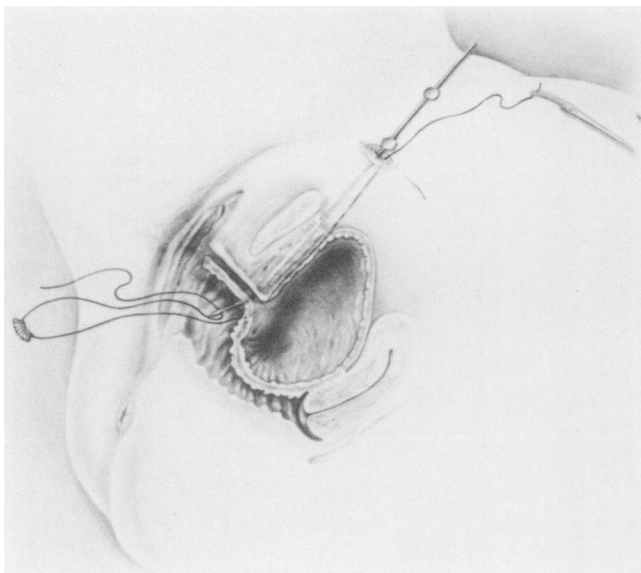


FIG. 2. The basic technique of endoscopic suspension of the vesical neck. After each passage of the needle, before threading the No. 2 monofilament nylon through the needle eye, the right angle cystoscope is introduced into the bladder to insure that the needle has not penetrated the bladder and that the needle is placed exactly at the internal vesical neck. Reprinted by permission of Surgery, Gynecology and Obstetrics.²

on top of the anterior rectus fascia. If this fascia is weakened from previous surgery or atrophy, each nylon suture can be passed through a button of silicone to reinforce the weakened fascia. The suprapubic incisions are then closed subcutaneously with 4-0 chromic and the skin with nylon suture.

The patient can be discharged two or three days after operation with her suprapubic Malecot catheter in place; voiding exercises are usually started on the fourth or fifth postoperative day.

Results

As seen in Table 1, this report on 203 patients operated on between December 1973 and May 1979 represents the most significant analysis and follow-up data on the results of this operation to date. It is important to describe the characteristics of this referral population, because a 90% cure rate is not uncommon for many operations that achieve minimal elevation of the vesical neck when surgery is limited to those patients with Grade I stress incontinence. As few as 43 of these 203 patients had simple SUI (Table 2); 119 patients lost urine with the slightest physical activity and 41 were totally incontinent. As shown in Table 3, about one in five of all referrals for this operation have been for total urinary incontinence.

† Vance Products Inc., 165 S. Main Street, Spencer, IN 47460.

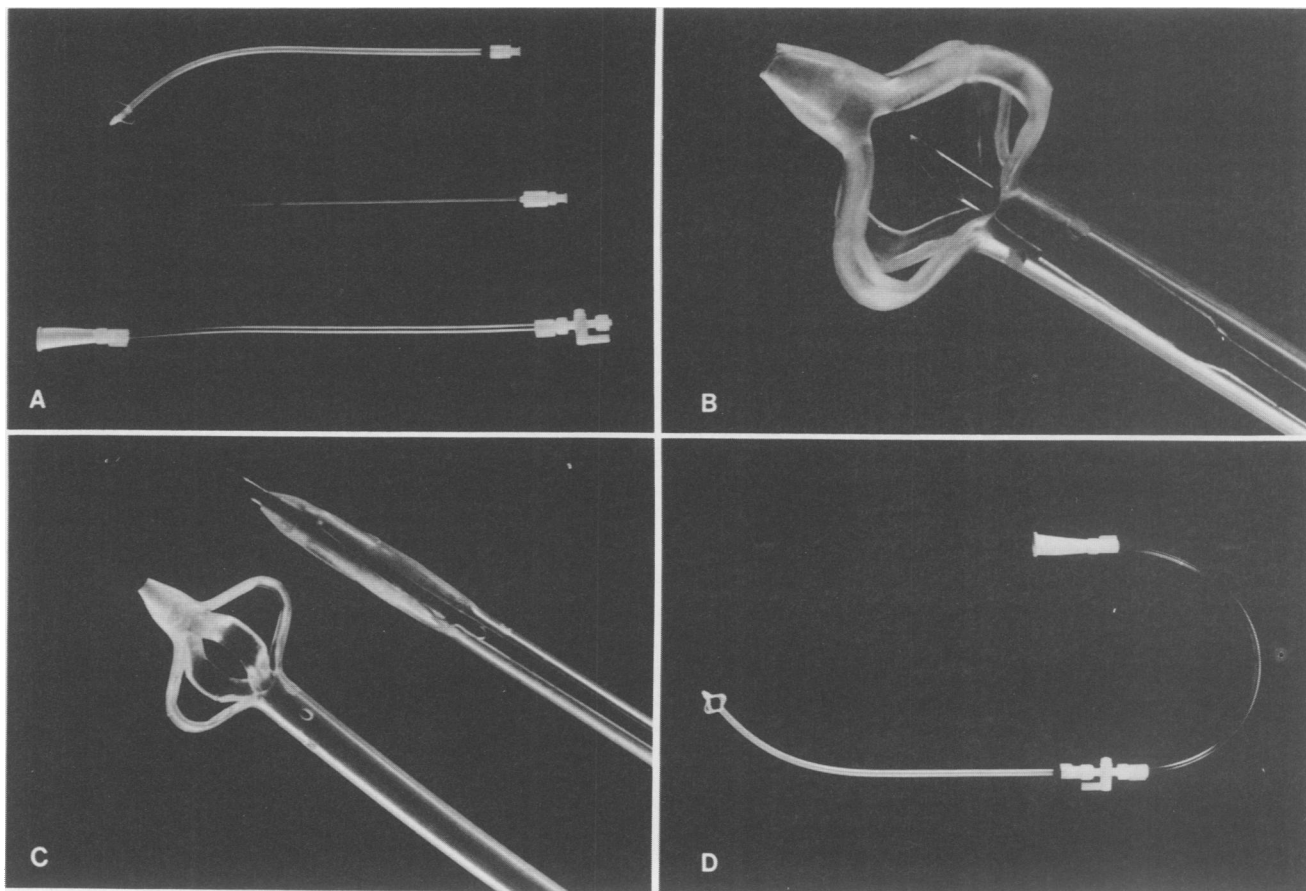


FIG. 3. A useful, 14 Fr percutaneous suprapubic tube for draining the bladder and retraining the patient to void after surgery. (A) The Malecot, polyethylene tube, 14 Fr; the needle obturator; and the connecting tubing with a luer-lock, stopcock valve for opening and closing the tube. (B) The needle obturator is passed down the tube and guided through the distal end, collapsing the Malecot wings as shown in (C). (D) The needle obturator is removed and the connecting tubing luer-locked to the suprapubic tube. The proximal end of the connecting tube is polyvinyl and fits any standard drainage bag.

The severity of the urinary incontinence in this series is confirmed by an analysis of the previous surgical procedures performed in an attempt to correct the incontinence (Table 4). In the present series, 188 operations (including 74 Marshall-Marchetti retropubic urethropexies) were performed prior to referral.

Of the 19 failures in the 1980 series, nine patients presented with total urinary incontinence; thus, nearly

half (47%) of all the failures came from those patients with complete incontinence (Table 5). Nevertheless, 32 of the 41 patients with total incontinence were cured by endoscopic suspension.

The mean age of the 1980 series was 56 years with a range from 15 to 87 years of age. A previous hysterectomy had been performed in 138 of the 203 patients.

TABLE 1. *Historic Results of the Stanford Series*

Reporting Dates	Study	Number of Patients	Number of Failures	Per Cent Cured
August 1969–May 1972	Stamey ¹	16	5	69
May 1972–December 1973	Stamey ²	44	3	93
December 1973–May 1979	Present series	203	19	91

TABLE 2. *Degree of Urinary Incontinence in 203 Patients (Present Series)*

Grade and Characterization of Incontinence	Number of Patients
I (Coughing)	43
II (Walking)	119
III (Total*)	41
	203

* Total incontinence is defined as the inability to hold any urine (<30 ml) in the bladder in the upright position.

TABLE 3. Number of Patients Referred with Total Urinary Incontinence

Study	Number of Patients	Number with Total Incontinence	Per Cent with Total Incontinence
Stamey ¹	16	5	31
Stamey ²	44	9	20
Present series	203	41	20

The 19 failures were equally distributed between these 138 and the remaining 65 whose pelvic organs were intact.

Bladder capacity, measured as either the voided volume or, when the voided volume was small, the volume used to fill the bladder in order to demonstrate urinary leakage, is shown in Table 6. As to residual urine at the time of catheterization, 162 of the 203 patients had less than 60 ml, 24 had more than 60 ml, and data are lacking in 17 patients. Most of the 24 patients with more than 60 ml of residual urine had less than 100 ml with the exception of four patients who were recognized to have neuropathic bladders in addition to SCUI and in whom intermittent self-catheterization was planned as part of their post-operative management.

Preoperative urethral length, measured with a Foley catheter, was recorded in 164 of the 203 patients as a mean length of 2.6 cm. At the termination of surgery, urethral length was recorded in 130 patients to average 4.0 cm.

The percutaneous suprapubic Malecot tube was removed postoperatively when the patient was able to consistently void about 75% of her bladder volume. The time required for the patients to achieve this degree of bladder emptying varied between one and 120 days; in half of the patients, the tube could be removed by the seventh postoperative day. More than 30 days passed before 14 of the 203 patients could void well enough to have their tube removed.

All 203 patients were followed for a minimum of six months. Forty-seven patients have been followed for over four years, and the remaining 156 between six months and four years. Failures tend to occur early rather than late. To date, only one patient has failed

TABLE 5. Analysis of Failures in Relation to Those with Total Incontinence

Study	Number of Patients	Number of Failures	Number of Failures With Total Incontinence Before Surgical Repair	Number With Total Incontinence
Stamey ²	44	3	2	9
Present series	203	19	9	41

after one year, a 27-year-old woman who became totally incontinent after giving birth to twins in January 1975. She was successfully repaired by endoscopic suspension in early 1975. In November 1978, while climbing a telephone pole using spiked boots, she felt a "tearing" sensation in the suprapubic area and thereafter experienced urinary incontinence while jogging. She was reoperated and cured of her jogging incontinence. Several patients from the original series¹ are now ten years since their endoscopic suspension, including the 15-year-old girl with the "drainpipe" urethra and total incontinence from severe pelvic trauma who was described in detail in that report. She is now 25 years old, married, has a 2-year-old child from a cesarean section, and has remained completely continent since the day of her endoscopic suspension.

Discussion

The patient's medical history is obviously important, but I have not emphasized it because the key to an accurate diagnosis is the visual demonstration of urinary loss coincident with the rise and fall of increased abdominal pressure produced by coughing or laughing. It is surprising, and unfortunate, how many patients are operated on for urinary incontinence without the surgeon taking the time to demonstrate this simple mechanical loss of urine. Leakage of urine under any other circumstances than that produced by and coincidental with a rise in abdominal pressure is incurable by surgery. Indeed, surgically curable urinary incontinence (SCUI) in the female can literally

TABLE 4. Analysis of Surgical Operations for Urinary Incontinence Prior to Referral

Study	Number of Patients	Number of Previous Operations	No. of Previous Marshall-Marchetti Operations
Stamey ¹	16	29	5
Stamey ²	44	48	14
Present series	203	188	74

TABLE 6. Bladder Capacity at Outpatient Examination in the Present Series

Volume (ml)	Number of Patients
<250	21
250-350	55
>350	103
No data	24
	203

be defined as the visual demonstration of a simultaneous loss of urine with a rise and fall in abdominal pressure. With the exception of total urinary incontinence, the surgeon must be wary of any patient who loses urine unrelated to an increase in abdominal pressure. Four of the 19 failures in these 203 patients were operated on because of a highly suggestive history even though loss of urine could not be demonstrated on physical examination; they are the only four of the 203 patients who did not have physically demonstrable urinary incontinence with coughing. When urinary leakage cannot be demonstrated in the lithotomy position where the urethral meatus can be observed directly, and the patient must be examined in the standing position, the surgeon must be cautious. It is in the standing position that neuropathic bladders often show incontinence, but the loss of urine is never coincidental with a rise in abdominal pressure. Since the neuropathic bladder loses urine by a spontaneous contraction of the detrusor muscle, the loss of urine begins some 10 to 20 seconds after the cough or positional change that produced the contraction; moreover, because it is a voiding contraction, the urinary loss is often a stream of urine which the patient cannot suppress immediately nor is it preceded by any sense of urinary urgency. In SCUI, when the patient is examined in the standing position, the labia tend to form a dam which can prevent easy recognition of the fact that urine is leaking from the meatus coincident with the rise and fall of increased abdominal pressure.

Certain points in the patient's history are clearly important. Any neurologic or orthopedic history which may suggest neuropathic disease of the bladder should be elicited. The circumstances of the urinary loss are important, but are only helpful in Grade I SUI and may be misleading. We try to quantify the amount of urine lost during the day in terms of the number and saturation of protective pads. It is also helpful if the patient is dry in the recumbent position, especially at night when movement is minimal, but patients with Grade II incontinence can be wet at night while those with Grade III incontinence are wet all the time. The distinction between loss of urine in small spurts from a sharp rise in abdominal pressure in contrast to the loss of urine in large amounts from a detrusor contraction which has emptied the bladder is obviously useful in suspecting a neuropathic bladder.

Patients who present with only urgency incontinence—that is, their loss of urine occurs after they sense a desire to urinate—cannot be cured by surgery. We ask two questions: When you have a desire to urinate, do you lose urine before you can get to the toilet? If so, does this urinary leakage represent a small amount, a moderate amount, or most of the total you lose through-

out the 24 hours? The problem is that many patients with SCUI also have urgency incontinence and can be cured of both by surgical elevation of their vesical neck. The urgency incontinence in these patients with SCUI is presumably due to the funneling and low pressure of the internal vesical neck; as the detrusor pressure starts to rise, urine probably flows immediately into the proximal urethra, causing an uncontrollable desire to urinate. With restoration of the vesical neck from a dependent position in the pelvis to one high behind the symphysis pubis, urine presumably cannot enter the proximal urethra during the early phase of a rising voiding pressure. In our 1975 series of 44 patients, we carefully analyzed the preoperative and postoperative interrelationships of urgency incontinence which accompanied SCUI.² The surgeon should never operate on urgency incontinence which is unaccompanied by a demonstrable loss of urine with a rise in abdominal pressure. In general, however, it is true that those patients with SCUI who have a strong component of urgency incontinence may have some problems with urgency incontinence for the first six months after surgery even though they will no longer have demonstrable SUI. In this series of 203 patients, 69 had some component of urgency incontinence in the immediate postoperative period, but little remained after six months.

In the preoperative outpatient assessment where the bladder is catheterized for residual urine, the presence of residual urine—especially over 100 ml—should serve as a hallmark of a neuropathic bladder; the absence of residual urine does not exclude it. When the bladder is filled to a known volume in order to demonstrate SCUI, the surgeon might remember that a normal bladder should relax during gravity filling with a minimal rise in intravesical pressure. If the open syringe is carefully observed during filling, a spontaneous contraction is easily detectable by sudden rise in the level of water in the syringe which previously was steadily falling as more water is poured into the open syringe. The examiner can also observe the final pressure in the bladder before removing the catheter; it should be less than 15 cm of water above the level of the urethra if the patient is comfortably full without a strong desire to urinate. While these observations are interesting, and represent “free” information, it is a very rare woman with either SCUI or a neuropathic bladder who will demonstrate a spontaneous contraction during filling or a high intravesical pressure. Indeed, as we pointed out in the 1975 series,² cystometrograms proved singularly unhelpful in these patients, even in those with substantial urgency incontinence.

Preoperative urethroscopy, advocated by an increas-

ing number of gynecologists, is even more useless than cystometrograms and represents an unnecessary expense in the evaluation of patients with urinary incontinence. SCUI is proven by demonstrating urinary loss on physical examination; there is nothing to be seen in the urethra that will add to or change the singular significance of this observation. It should be emphasized that the diagnosis of SCUI requires only a bottle of water, a urethral catheter, an open syringe, and a doctor.

As we showed in our 1975 series,² mild to moderate cystoceles are corrected by endoscopic suspension alone. If, however, the preoperative outpatient examination discloses a large cystocele which extends below the vaginal introitus on straining or protrudes when the patient is in the upright position, the trigonal incision at the time of surgery should be extended to the vaginal vault or cervix and the cystocele repaired after placing, but not tying, the suspending sutures at either side of the vesical neck. Of even more importance, the surgeon should make certain preoperatively that lifting the bladder (which occurs markedly with endoscopic suspension) with a tongue depressor blade does not allow a large rectocele (heretofore counterbalanced against the cystocele) to protrude out the introitus. We failed to recognize this in three patients who returned postoperatively with a protruding rectocele which required surgical correction and should have been recognized and repaired at the time of the endoscopic suspension.

One of the advantages to endoscopic suspension is that it negates the gynecologic discussion of who should have a vaginal repair (anterior colporrhaphy) and who should have a retropubic procedure.³ In a careful radiologic study of preoperative and postoperative lateral chain cystograms in all patients undergoing an anterior colporrhaphy operation for SUI, Low reported a 1 cm "upward and forward elevation of the bladder neck" in the 50% of his patients who were cured by surgery.⁴ Because anterior colporrhaphy in the best of surgical hands can only move the internal vesical neck of the bladder 1 cm at best, it is not a good operation for SCUI. The mean elevation of the internal vesical neck achieved by endoscopic suspension is nearly 5 cm.² Because anterior colporrhaphy accomplishes such a minimal elevation of the vesical neck, it is perhaps understandable why the presence of the uterus represents a threat to a permanently successful operation. In many centers, hysterectomy is routinely performed as an integral part of the operation for SUI. It is difficult to justify removing a normal uterus solely because a patient has SUI. A strong and properly done operation, especially that of endoscopic suspension, should be able to suspend the internal vesical

neck of the bladder regardless of what happens to the uterus.

Endoscopic suspension is accompanied by minimal morbidity because an open pelvic operation is avoided. Not one of the 203 patients in this series required a blood transfusion, and we do not cross-match for it. Seven of these 203 patients required a second endoscopic suspension for cure of their incontinence; in six of these seven patients, the necessity for reoperation was apparent immediately after the first surgery. No difficulties were encountered in these reoperations. The original Dacron tubes are usually so infiltrated with connective tissue that they are either not seen during the procedure or can be left in position as additional buttresses.

In conclusion, the advantages to endoscopic suspension appear to be the following. 1) Use of the heavy monofilament nylon passed through the Dacron buttress offers a stronger suspension of the internal vesical neck than can be accomplished by a retropubic procedure. 2) Since the cure of urinary incontinence depends exclusively on raising the internal vesical neck of the bladder upward and forward behind the symphysis pubis, the cystoscope offers the most accurate way of placing the suspending sutures exactly at the bladder neck. At open surgery, any tension on the Foley balloon tends to "telescope" the fallen urethra on itself, often making it difficult to know with precision the exact position of the internal vesical neck. 3) Physiologic measurements of continence can be made before closing the incisions. If these observations fail to confirm that the incontinence has been corrected, the suspending sutures can be changed to a more advantageous position. 4) Open pelvic surgery is avoided, thereby decreasing operative morbidity; blood loss is insignificant. 5) It is clearly the ideal operation for the surgically difficult pelvis, for example, severe pelvic fractures, radiation incontinence, obesity, and multiple operative failures. 6) Simultaneous repair of significant rectoceles or substantial cystoceles can be performed through the same operative field.

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