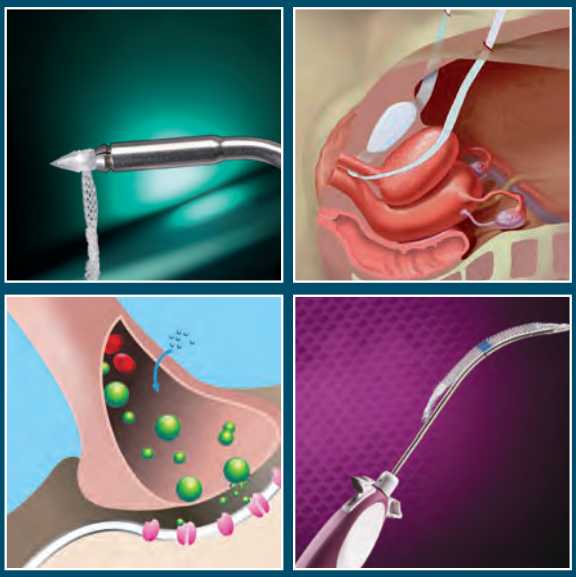
Alois Martan et al.

NEW SURGICAL TECHNIQUES AND MEDICAL TREATMENT IN UROGYNECOLOGY



Treatment of Stress Urinary Incontinence, Pelvic Floor Defects, and Overactive Bladder in Women

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NEW SURGICAL TECHNIQUES AND MEDICAL TREATMENT IN UROGYNECOLOGY

Treatment of Stress Urinary Incontinence,
Pelvic Floor Defects, and Overactive Bladder in Women

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Alois Martan et al.: New Surgical Techniques and Medical Treatment in Urogynecology

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FOREWORD

Urogynecology is an evolving subspecialty that is gaining public health interest and importance given the aging of the population. Urogynecology is a surgical subspecialty of gynecology that is acknowledged in most European countries.

The current edition of *New Surgical Techniques and Medical Treatment in Urogynecology*, by Prof. Alois Martan, is an exceptional book that discusses all of the major aspects of pelvic floor disorders, such as their anatomy, physiology, examination and pathophysiology; it summarizes surgical procedures for incontinence and prolapse as well as drug therapy for incontinence and overactive bladder. The chapters describe evidence-based results and comprehensively address the various issues with support from the author's long-standing clinical and scientific experience.

The book is a pearl for all persons in training for urogynecology and will serve as a handbook well worth reading even for the experienced surgeon. Novel techniques as well as complex aspects of pharmacotherapy are presented in a comprehensive manner. Overall, the reader will have an up-to-date overview of the complex field of urogynecology.

It will be beneficial for general gynecologists with an interest in urogynecology as well as urologists.

In the future, almost all specialties in medicine will be confronted with an aging population. In urogynecology in particular, it is important to offer a certain "repertoire" of surgical techniques that permit the individualization of surgical treatments.

This book aids in understanding and determining the best technique for a given individual.

Professor Dr. Med. Annette Kuhn
Frauenklinik Bern, Switzerland

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ABBREVIATIONS

ADH ..... antidiuretic hormone
ATFP ..... tendinous arch of the pelvic fascia (Arcus tendineus fasciae pelvis)
ATP ..... adenosine triphosphate
AUGS ..... American Urogynecological Society
BBB ..... blood-brain barrier
BFLUTSQ ..... Bristol Female Lower Urinary Tract Symptoms Questionnaire
BMI ..... body mass index
CDV ..... color Doppler velocity
Charr ..... Charrière
CI ..... confidence interval
CLPP ..... cough leak point pressure
CNS ..... central nervous system
CRADI ..... Colo-Rectal-Anal Distress Inventory
CRAIQ ..... Colo-Rectal-Anal Impact Questionnaire
DOI 2,5-dimethoxy-4-iodophenylizopropylamine
EMG ..... electromyography
FDA ..... Food and Drugs Administration
gh ..... genital hiatus
ICIQ-UI SF ..... International Consultation on Incontinence Questionnaire Short Form
ICS ..... International Continence Society
IEF ..... Incontinence Episode Frequencies
I-QOL ..... Incontinence-Specific Quality of Life Questionnaire
IIQ ..... Incontinence Impact Questionnaire
ISD ..... intrinsic sphincter deficiency
IUGA ..... International Urogynecological Association
IVS ..... intravaginal slingplasty
IVU ..... intravenous urography
LPU ..... low pressure urethra
LUTD ..... lower urinary tract dysfunction
LUTS ..... lower urinary tract symptoms
MAUDE ..... manufactured and user facility device experience
MMK ..... Marshall-Marchetti-Krantz (procedure)

MUCP ..... maximum urethral closure pressure
MUP ..... maximum urethral pressure
NE ..... norepinephrine (noradrenaline)
OAB ..... overactive bladder
OD ..... obstructive discomfort
pb ..... perineal body
PDS ..... poly-p-dioxanone suture
PFMT ..... pelvic floor muscle training
PISC12 ..... Pelvic Organ Prolapse / Urinary Incontinence Sexual Function Questionnaire
POP ..... pelvic organ prolapse
POPDI ..... Pelvic Organ Prolapse Distress Inventory
POPIQ ..... Pelvic Organ Prolapse Impact Questionnaire
POP-Q ..... Pelvic Organ Prolapse Quantification
PPIUS ..... Patient Perception of Intensity of Urgency Scale
PVD ..... paravaginal defect
PVDR ..... paravaginal defect repair
PWT ..... pad-weighing test
Q ..... urine flow
QoL ..... quality of life
RR ..... risk ratio
RVT ..... retroversion flexion
SANS ..... Stoller afferent nerve stimulation
SIMS ..... Single-incision mini-slings
SIS ..... Single-incision sling
SMUS ..... standard midurethral slings
SNRI ..... serotonin norepinephrine reuptake inhibitor
SUI ..... stress urinary incontinence
TOT ..... transobturator tape (out-in)
TVL ..... total vaginal length
TVT ..... tension-free vaginal tape
TVT-O ..... transobturator tape (in-out)
TVT-S ..... TVT Secur system
UDI ..... Urinary Distress Inventory
UI ..... urinary incontinence
UIQ ..... Urinary Impact Questionnaire
US ..... ultrasound imaging
USI ..... urodynamic stress incontinence
UVJ ..... urethrovesical junction
VCU ..... video cystourography
VLPP ..... Valsalva leak point pressure
VUDS ..... video urodynamics

1 INTRODUCTION

The aging of our population and the pursuit of a good quality of life for women in old age has led to an attempt to solve the problem of pelvic organ prolapse. Such difficulties often occur later in life and may be associated with problems such as urine and stool incontinence, as well as feelings of tension and stress in the genitals. New investigative techniques and an improved understanding of the pathophysiology of these disorders facilitate their effective treatment. Unfortunately, questions sometimes arise concerning who should handle these problems: a gynecologist, urologist, or colorectal surgeon. In the treatment of some complicated cases, the cooperation of all experts is ideal. At present, we are training specialists who will handle these cases based on additional specialized education.

The International Continence Society (ICS) and the International Urogynecological Association (IUGA) are currently addressing pelvic organ prolapse and urinary incontinence (UI). One of their main aims is to standardize terminology for the function of the lower urinary tract and pelvic organs. Such standardization will facilitate good communication among professionals who handle these problems. UI in women is not a disease in the strict sense but rather a symptom that has different causes. It is defined as the complaint of any involuntary leakage of urine.

Large epidemiological studies suggest that the prevalence of UI in women ranges between 25 and 40% [1, 2]. Stress urinary incontinence (SUI), a passive leakage of urine through the urethra due to increased intra-abdominal pressure resulting from insufficiency of the locking mechanism without simultaneous contraction of the detrusor muscle, affects approximately 50% of incontinent women. Overactive bladder (OAB) has a typical set of symptoms

of dysfunction of the lower urinary tract. Urgency is the primary symptom of OAB; it is often associated with incontinence and with frequent urination and nocturia. This syndrome affects the physical and emotional well-being of patients and significantly decreases the quality of life. In the general population over 40 years, the prevalence of OAB is approximately 18%. It increases in frequency with age, and in people over 75 years of age, the prevalence of OAB ranges from 31 to 42% [3, 4].

New medical treatments for OAB are more effective and have lower risks of side effects. Current surgical procedures are also better at treating problems associated with SUI and pelvic floor reconstruction. Postoperative recovery is shorter, and operations are more likely to succeed. Therefore, many women consider the inconveniences that incontinence, symptoms of urgency, or pelvic organ prolapse bring to their daily life, decide to address this problem, and entrust doctors with the treatment of their condition.

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7.5 VAGINAL TENSION-FREE TAPE SURGERIES

In 1995, the work of Ulmsten and Petros opened new opportunities for surgical methods to treat SUI with tension-free tapes, such as TVT®. These tapes are inserted behind the symphysis and placed under the mid-urethra [8, 9, 10]. In this operation, the tape is extended under the urethra and behind the symphysis and is held in place by the so-called *velcro* effect between the living tissue and the synthetic material until it heals. This surgical method is different from previously preferred surgical approaches, i.e., surgeries in the bladder neck area.

7.5.1 Tension-Free Vaginal Tape (TVT)

With this minimally invasive surgical technique, we attempt to replace damaged pubourethral ligaments and contribute to the support of the mid-urethra [11]. The surgical kit includes polypropylene tape that is 11 mm wide and 45 cm long. Both ends of the tape are connected with steel needles that are 5 mm in diameter. The tape is in a plastic sheet, which facilitates insertion through tissues and prevents contamination and stretching during retropubic placing. The needles have threads at their blunt ends to facilitate their connection with the steel handle of the inserter. The kit also includes a steel guide that is inserted into the transurethral catheter (18–20 Fr), thereby causing rigidity and allowing manipulation of the bladder neck during surgery (Figure 7-2). There are many other retropubic tapes that are inserted similarly. Various types of tapes differ in the way the needles are inserted, whether from the vaginal incision with insertion suprapubically or vice versa, such as Align™ (Bard, Murray Hill, New Jersey, USA) and others.

Surgical Technique

The patient is placed in the lithotomy position. The angle of flexion of the lower limbs in the hip joint should be, relative to the horizontal line, between 45° and a maximum of 60° (Figure 7-3). The surgical procedure is accompanied by mild sedation. First, the surgical field is disinfected, and a single dose of antibiotics is administered. Then, a diluted local anesthetic is applied in a to-

tal volume of 100 ml (40 ml of 1% trimecaine + 60 ml sterile saline solution) from the vagina bilaterally and paraurethrally towards the bottom edge of the symphysis and potentially behind it. Concomitantly, analgosedation is administered. From the lower abdomen, the subcutaneous and retropubic tissues are infiltrated bilaterally, approximately 2 to 3 cm from the midline. This allows better management of hydrodissection and guidance of the needle with tape. Next, a short bilateral suprasymphyseal incision is made 2 to 3 cm from the midline. Subsequently, the medial incision is followed into the anterior vaginal wall for approximately 1.5 cm, beginning approximately 1 cm from the external urethral orifice. The edges of the vaginal wall are grasped with forceps or clamp forceps. From the vaginal incision, narrow scissors are used to create a thin paraurethral dissection of two tunnels (approximately 2.5 cm in length) toward the skin incisions. During the surgery, a Foley catheter is inserted into the bladder. Before inserting the needle with the tape, a metal guide is placed into the catheter with its distal end fixed to the catheter. This procedure facilitates manipulation of the urethra and its displacement from the position where the needle with tape penetrates. When guiding the needle to the right side of the patient, the distal portion of the catheter is placed on the right, and when guiding the needle to the left, the

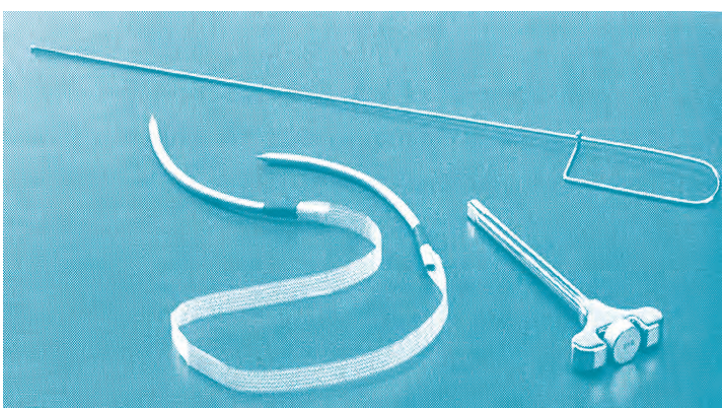


Figure 7-2 Surgical kit for TVT procedure.

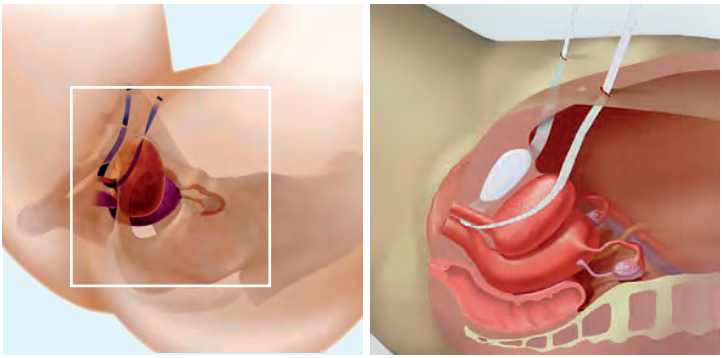


Figure 7-3 Retropubic tape guidance—TVT.

catheter is on the left. The needle is attached to the handle of the inserter and then inserted into the dissected paraurethral space. Using pressure, it is guided behind the lower edge of the inferior pubic ramus while penetrating through the urogenital diaphragm (perineal membrane). The dissection is continued to just behind the symphysis through the Retzius space, fascia or attachment of the rectus abdominis muscle, through the subcutaneous tissue and the suprapubic incision. The same procedure is repeated on the other side. It is most commonly performed on the left side, as we usually start at the right. The needles are left in place on both sides and, after filling the bladder with 300 ml of sterile fluid, cystoscopy is performed to determine the integrity of the bladder wall. If the wall is perforated, then the needle must be removed and re-inserted. The tape is inserted in a plastic sheet, which facilitates insertion through tissues, and the needles are cut off on both sides. The tape is tightened slightly, and the cough test is performed. During the cough, there should be no substantial fluid leakage. If there is a leak, then the tape is tightened slightly more. Scissors are placed between the tape and the urethra, and the plastic sheet is removed, leading to its fixation to the surrounding tissues. Next, the visible parts of the tape are trimmed, absorbable sutures are placed in the vaginal wall and skin, and vaginal packing may be performed. If necessary, the Foley catheter is kept in place until the next day.

Complications

One of the most common complications is perforation of the bladder by the guide needle during the procedure [12]. It may be necessary to reinsert the needle, potentially after previous repeated hydrodissection, to facilitate better placement of the needle behind the pubic bone. Postoperatively, the Foley catheter is left in place for five to ten days, depending on the extent of bladder trauma, and antibiotics are administered.

Another possible complication is bleeding from broken blood vessels located behind the pubic bone or at its lower edge (Figure 7-4). Bleeding can usually be stopped by vaginal packing of the vagina or compression of vessels using the surgeon's fingers. If vigorous bleeding continues, a surgical revision of the retrosymphyseal space is required **[►Video 1; Revision of Retzius space]**, which can be performed during surgery or postoperatively, if there are signs of anemia or a significant hematoma is assessed during US examination. Minor hematomas up to approximately 5 cm in diameter may not

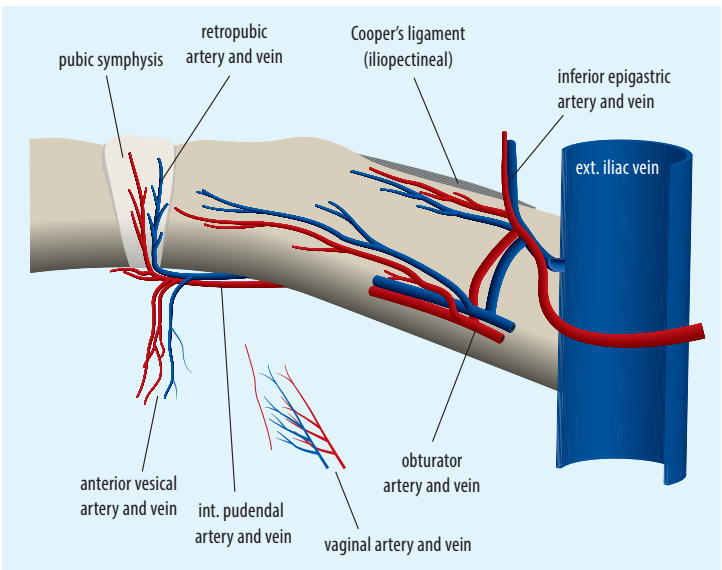


Figure 7-4 Schematic representation of blood vessels in the retropubic space.

require revision, as long as they are not increasing in size, are not infected, are not associated with an abscess, and do not compress the surrounding structures. Other important factors are the preoperative medical history, the presence of coagulation disorders, and the use of anticoagulant or antithrombotic therapies. Postoperatively, micturition disorders of varying degrees may also occur, from reduced urine flow to urinary retention [13]. We select the method of treatment according to the degree of the disorder. If we find this type of disorder immediately after the procedure, we may try to introduce a Hegar's metal dilator or a metal catheter into the urethra. With subsequent pressure, we may try to use these instruments towards the perineum to partially release the tape. Another common option is urethral dilation using Hegar's dilators. In more severe disorders of urinary flow (i.e., when the patient is suffering from urinary retention), we can release the suture of the vaginal incision and attempt to tie the tape distally (toward the perineum) on the second or third postoperative day, under general anesthesia. If this maneuver is unsuccessful and if testing of the urethral lumen by calibration probes reveals a marked narrowing of the urethra, it is necessary to cut the tape. The tape is cut even in patients in with a significant restriction of urinary flow later after surgery. These patients may develop new symptoms and signs of urgency *de novo*. Other serious complications, such as trauma to the major vessels or intestinal perforation, occur very rarely but require surgical re-exploration of the abdominal cavity along with abdominal or vascular surgery.

Success Rate

The success rate of TVT surgery usually ranges from 80 to 90% [14, 15, 16, 17] depending on the time interval after the operation. The subjective evaluation of the effect of the operation is slightly lower. This success rate is comparable to that of operations in which the tape is guided around the lower arm of the pubic bone, such as TOT or TVT-O. Many studies using retropubic tape guidance have described a higher rate of peri- and postoperative complications. This type of surgery is currently recommended for patients with ISD and with less mobility of the urethra, who are more likely to benefit from a TVT operation than from transobturator tape placement. The effi-

cacy of the operation likely depends on accurate and sufficient tightening of the tape and good fixation to the surrounding tissues [18].

7.5.2 Transobturator Tape

The introduction of sub-urethral tape into surgery significantly altered the management of SUI. The concept of tension-free tapes made from Prolene monofilament, placed under the middle urethra using minimally invasive surgical techniques, has been widely accepted by experts as an alternative to earlier operations for SUI. TVT surgeries were associated with a larger number of possible minor or major complications. Therefore, most surgeons switched to operations in which the tape is guided around the lower arms of the pubic bone (TOT, TVT-O) [19].

In 2001, Delorme introduced the transobturator approach of out-in tape guidance. His aim was to avoid complications associated with blind trocar insertion into the retropubic space and to better harmonize tape placement with the pelvic anatomy [20, 21]. In 2003, De Leval introduced the in-out transobturator tape insertion (TVT-O) into surgery. In this procedure, the tape is inserted from an

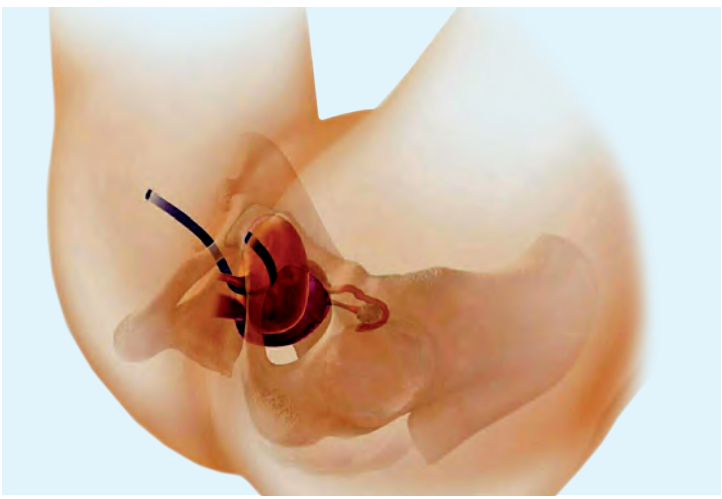


Figure 7-5 Transobturator tape guidance.

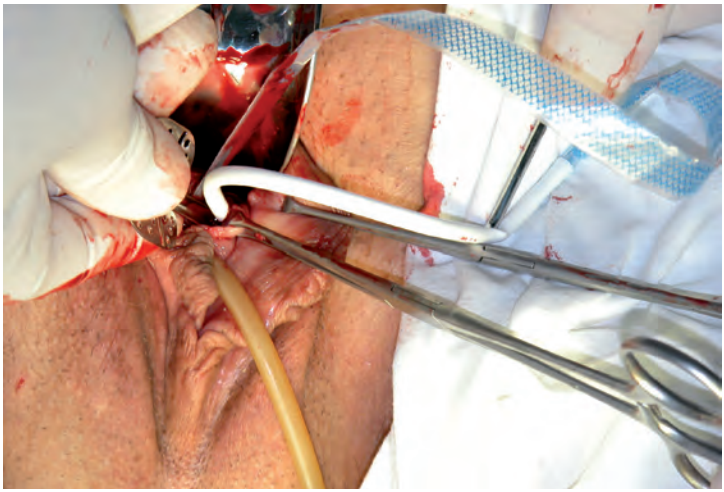


Figure 7-6 TVT-O (in-out).

incision on the anterior vaginal wall around the ischiopubic ramus of the pubic bone (Figure 7-5) [22].

7.5.2.1 TOT, TVT-O (TRANSOBTURATOR TAPE/OUT-IN, IN-OUT)

The surgical kit includes a polypropylene tape that is 11 mm wide and 45 cm long. Both ends of the tape are connected with a pointed polyethylene tube (needle). The tape is in a plastic sheet, which makes it easy to move it through the tissues, prevents stretching, and protects the tape from contamination. In addition, there are two disposable metal helical passers with a handle. We slide these pointed plastic tubes over the inserter, which can then be properly inserted and placed with a grooved metal guide that is also included in the kit. It is 6 cm long and can be extended by 1 cm for surgery in obese women by bending its lateral wings. The guide helps to place the needle with the tape and pushes on the bladder wall during insertion of the tape (Figure 7-6).

Surgical Technique

The patient is placed in the lithotomy position. A Foley catheter is inserted into the bladder, emptying the bladder prior to surgery. The

angle of flexion of the lower limbs at the hip joint should be 90° and, according to some recommendations, up to hyperflexion of 110°. We usually perform the procedure under general anesthesia or local anesthesia with analgosedation after a single dose of antibiotics. After grasping the anterior vaginal wall with surgical forceps, we apply 2 ml of 4% articaine (diluted with a sterile solution to a total volume of 20 ml) bilaterally under the vaginal mucosa, i.e., 10 ml on each side. Articaine with epinephrine reduces bleeding in the operating field through vasoconstriction. If the procedure is performed under local anesthesia with analgosedation, we use a solution of 30 ml of 1% trimecaine + 30 ml sterile saline (60 ml total) for hydrodissection and regional anesthesia. We make a 1.5-cm sub-urethral incision that begins approximately 1 cm from the external urethral orifice. First, the edges of the vaginal wall are grasped with forceps. Then, after a short sharp release of the vaginal mucosa from the surrounding tissue, blunt dissection is continued laterally clockwise to 3 and 9 o'clock, i.e., bilaterally toward the bottom of the ischiopubic ramus of the pubic bone. Next, the procedure is continued slightly behind the ischiopubic ramus, using narrow scissors. The angle between the axis of the scissors and the sagittal plane should be approximately 45°. The tunnel ends at the obturator internus and is approximately 3.5 cm long and 0.8 cm wide. During the operation, the tunnel facilitates guidance of the plastic needle with the inserter and tape. Previous hydrodissection of submucosal tissue facilitates the subsequent blunt dissection. Tunnel preparation is initiated on the patient's right side. The plastic needle resides on a spiral metal

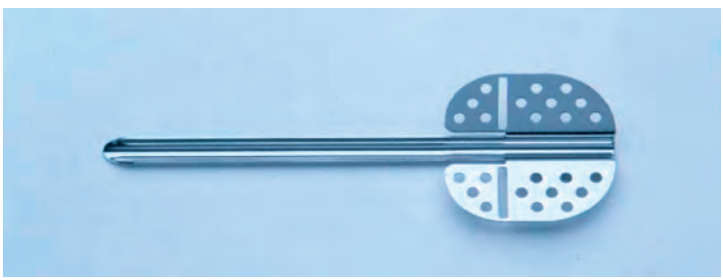
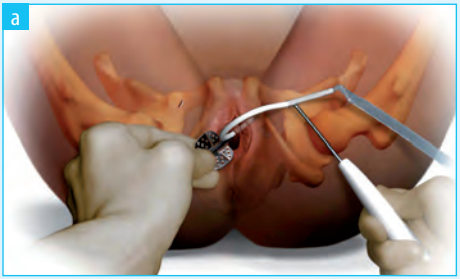
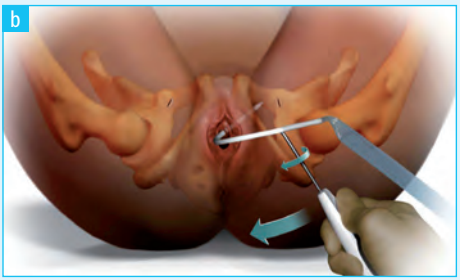


Figure 7-7 Metal guide for a plastic tube with a guide.

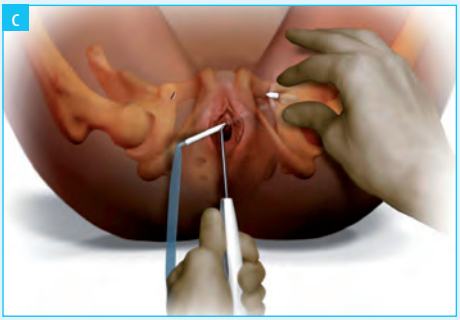
inserter and is attached to the tape in the plastic sheet. A winged, grooved 6-cm metal guide can be extended by 1 cm by bending the lateral wings during surgery in obese women, in whom the inner edge of the ischiopubic ramus of the pubic bone is farther away (Figure 7-7). This guide facilitates guidance of the needle with tape and pushes on the bladder wall during the insertion. The guide is inserted into the prepared tunnel, and subsequently, a plastic needle is placed on a spiral inserter. Close to the perineum, the axis of the inserter handle is at an angle of approximately 20° relative to the sagittal plane. At the beginning of the procedure, on the patient's right side, the surgeon holds the inserter in the left hand and uses the index finger of the right hand to control insertion of the needle guide. The right thumb pushes the metal guide, thus facilitating penetration of the needle into the obturator internus, the membrane of the obturator foramen, the obturator externus muscle, the adductors, the subcutaneous tissue, and the skin. Concomitantly, the left hand rotates the inserter about its axis in a sagittal plane. This process allows penetration of the needle with tape around the inside edge of the lower part of the pubic bone. The right hand completes the rotation of the needle and eventually takes over the rotation of the inserter. Next, the tip of the needle is inserted through the skin, approximately 2 cm above the horizontal plane, passing through the external urethral orifice and approximately 1.0 to 2.0 cm laterally from the genitofemoral groove. Two short incisions at the site of the planned procedure will facilitate the insertion of the plastic needle. Subsequently, the metal guide of the inserter is removed, and the plastic needle connected to the tape covered with plastic sheet is extracted. The needle is extracted so that the center of the tape at the point of interruption of the plastic sheet is located approximately 2 cm from the incision at the anterior vaginal wall. The same procedure is performed on the other side, i.e., on the left side of the patient. Scissors are then placed between the tape and the urethra, the tape is tightened, the plastic needles are cut off, and the support of the urethra by the tape is re-examined. Scissors remain between the tape and the urethra. We then remove the plastic sheet from the tape. To ensure a tensionless placement of the tape under the urethra, the surgeon may grasp its center before removal of the plastic cover



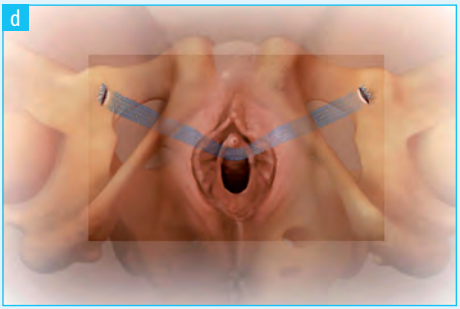
A winged, grooved metal guide facilitates guidance of the needle with tape and pushes on the bladder wall during the insertion.



Close to the perineum, the axis of the inserter handle is at an angle of approximately 20° relative to the sagittal plane.



The surgeon's right hand begins the rotation of the inserter at the patient's left side, and the left hand completes it.



Placement of the tape under the urethra.

Figure 7-8 Operational steps for TVT-O procedure.

with Allis forceps. The tape then creates an approximately 2-mm-long loop, which is released after its extraction and prevents overtightening of the tape. Then, perhaps only a minimal correction of tape tightness is needed, as the tape is secured to the surrounding tissues through the so-called *velcro* effect (Figure 7-8). The next step is to suture the vaginal wall, most often using a resorbable suture. We do not suture the skin incisions unless bleeding has occurred. In that case, we use a single resorbable stitch. We may follow up with vaginal package, especially if there is heavier bleeding during the procedure. We may remove the Foley catheter immediately after an uncomplicated surgery or leave it in place until the next day. After catheter removal, the patient may be discharged if she can urinate and in the absence of high residual volume or other difficulties. The patient may also be discharged on the evening of surgery. In that case, the catheter is removed immediately after surgery and vaginal packing is not performed. We do not routinely perform cystoscopy.

When using the TOT out-in operating procedure, the tape guidance is similar. The only difference is that the needles that allow placement of the tape are inserted from outside to inside, as in the Align™ TO (Figure 7-9) or Monarc™ systems (Figure 7-10).

Complications

Compared with TVT, complications are less common with TOT and TVT-O. However, more intense bleeding from the vaginal incision may occur. To address this issue, we usually only compress the vaginal wall during the procedure. After the procedure is complete, we perform vaginal packing [23]. In the case of continuous bleeding, we place a spiral suture in anterior vaginal sulci, approximately 2 cm higher than the end of the proximal vaginal incision. After tightening of the stitch, the bleeding should stop or diminish. Neuman reported the beneficial effect of these stitches and explained their effect by ligation of the vessels that run along the inner surface of the anterior vaginal wall [24].

Perforation of the bladder is quite rare and is detected by leakage of fluid along the guide or tape after its introduction. Subsequently, bloody urine drains from the bladder through the catheter. Follow-up by cystoscopy will confirm the presence of bladder trauma.

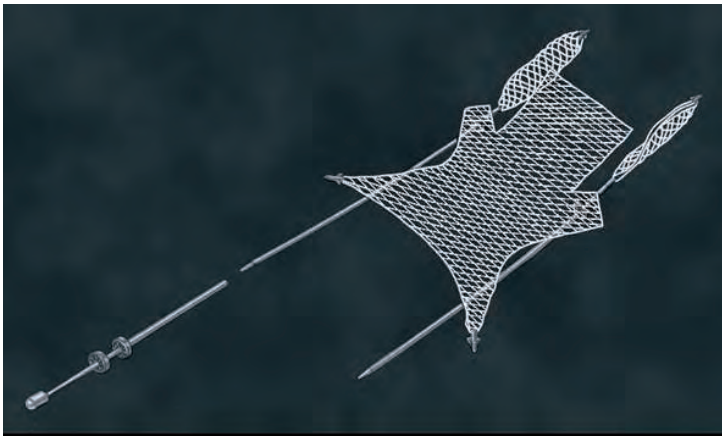


Figure 9-6 Implant for treating defects of the anterior and apical compartments, anchoring polypropylene strips and plastic rings for fastening.

This material produces only minimal inflammatory cell reactions. Because it is lightweight and has a small surface, the foreign body reaction is minor. The absorbable mesh component, polyglecaprone (Monocryl), increases the implant's stiffness, assists in its placement. After insertion, the material degrades and the mesh becomes more elastic, approaching the elasticity of the abdominal wall. The mesh weight decreases from 57 g/m^2 to 28 g/m^2, while the pore size increases from 2.5 mm to 4.0 mm. The mesh is constructed such that its expansion is laterally smaller and larger in the longitudinal direction. The greater longitudinal elasticity is crucial for preventing the development of dyspareunia (Figure 9-5).

A comparison of this mesh with classical meshes reveals that the rear portion of this mesh, which covers the posterior compartment, is 19 mm wider. The rear mesh arms are 17 mm longer, while the angle of the arm curvature is smaller.

9.1.1.3 ELEVATE™

The implant material weighs 25.2 g/m^2 and has a pore size of 2.4 mm^2. First, we will focus on the front and middle compartments and then on the middle and posterior compartments.

Elevate™ Anterior & Apical

Figure 9-6 shows a mesh with anchor polypropylene strips and fixing rings on a plastic rod for treating defects of the anterior and middle compartments [8].

Surgical Technique

The patient is placed in the lithotomy position. The angle of flexion of the lower limbs at the hip joint should be approximately 90°. The procedure is performed either under general or spinal anesthesia after a single dose of antibiotics. First, the anterior wall of the vagina is grasped with surgical forceps. Hydrodissection of the vaginal walls from the surrounding tissues is performed while instilling sterile solution with local anesthetic and a vasoactive substance such as articaine with epinephrine or lidocaine with norepinephrine. This causes vasoconstriction, thereby limiting bleeding. Hydrodissection facilitates identification of the correct layer when performing a longitudinal incision of the anterior vaginal wall. This incision begins at the level of the bladder neck and ends at the level of the apex. Therefore, it penetrates the full thickness of the vaginal wall under the pubocervical fascia (a whitish fibrous structure). Next, a blunt dissection is used to proceed bilaterally, usually with the finger, in the same plane as the ischial spine, which is palpated with the index finger. The tissue is then loosened with the index finger 2 to 3 cm towards the sacrum, revealing the sacrospinous ligament. Narrow scissors are used for blunt dissection at the level of the UVJ in the direction of the medial edge of the obturator foramen for approximately 2 cm. The implant, which has two arms with plastic anchors at one end, is prepared. The arms are placed on the tip of a metal guide and inserted bilaterally into the prepared tunnels. They are anchored in the obturator internus, somewhat lower than the position of the MiniArc™ tape because the mesh supports the UVJ while the tape supports the mid-urethra. First, we insert the arm with a plastic anchor on the right side of the patient. The right hand holds the handle of the guide. The index finger of the left hand controls the position of the tip of the guide with the anchor. Then, the front of the mesh is anchored on the left. Two to three slowly resorbable or non-absorbable sutures are placed on the vaginal apex, which is

grasped with forceps. The guide is then prepared with a handle. The plastic anchor with polypropylene tape is placed vertically at the top of the guide. The anchor is then covered with plastic tubular sheet up to the transition from the guide to the handle. After its placement, the cover is fixed to the handle. Using two fingers of the right hand, the right ischial spine is palpated. The guide with its plastic cover is inserted medially, approximately 2 to 3 cm from the ischial spine, between the fingers of the right hand. After placing it on the sacrospinous ligament approximately 2 to 3 cm from the ischial spine, the guide with its cover is pressed against the ligament. Simultaneously, the lever on the handle is pressed, which allows placement of the plastic anchor into the ligament. The same procedure is performed on the other side. Here, the right hand holds the guide with the cover. After insertion and fixation of both tapes, the implant is slipped over the tapes with plastic rods by means of two holes that are located on the implant. If needed, the implant is trimmed in the proximal portion to match the length of the vagina. The stitches are passed from the vaginal apex through the proximal part of the mesh and tied. Beginning on the left side of the patient, the rings are pulled over the plastic rods. The plastic rods together are positioned with another long plastic rod with a bent end that opens up to the mesh, thus fixing the mesh to the tape (Figure 9-7). Finally, the excess portion of the tape is trimmed. Before fixation at the right side, the tape is checked *per rectum* to evaluate whether the mesh between the fixing strips is not too tight. If so, it is loosened slightly by pressure from the rectum. A minor vaginal wall resection may then be performed. One or two layers are then sutured using a continuous absorbable suture **[►Video 8; Elevate™ ant]**.

Complications

The most common complication during surgery is bleeding, which is stopped with diathermocoagulation or compression. If the operation is performed in the correct layer, bleeding is usually minor. Another complication may be excessive tightening of the mesh to the fixation arms. Therefore, during the operation, the mesh tension is checked *per rectum* as stated above. It is rarely possible to perforate the bladder or intestine, which occurs most often during

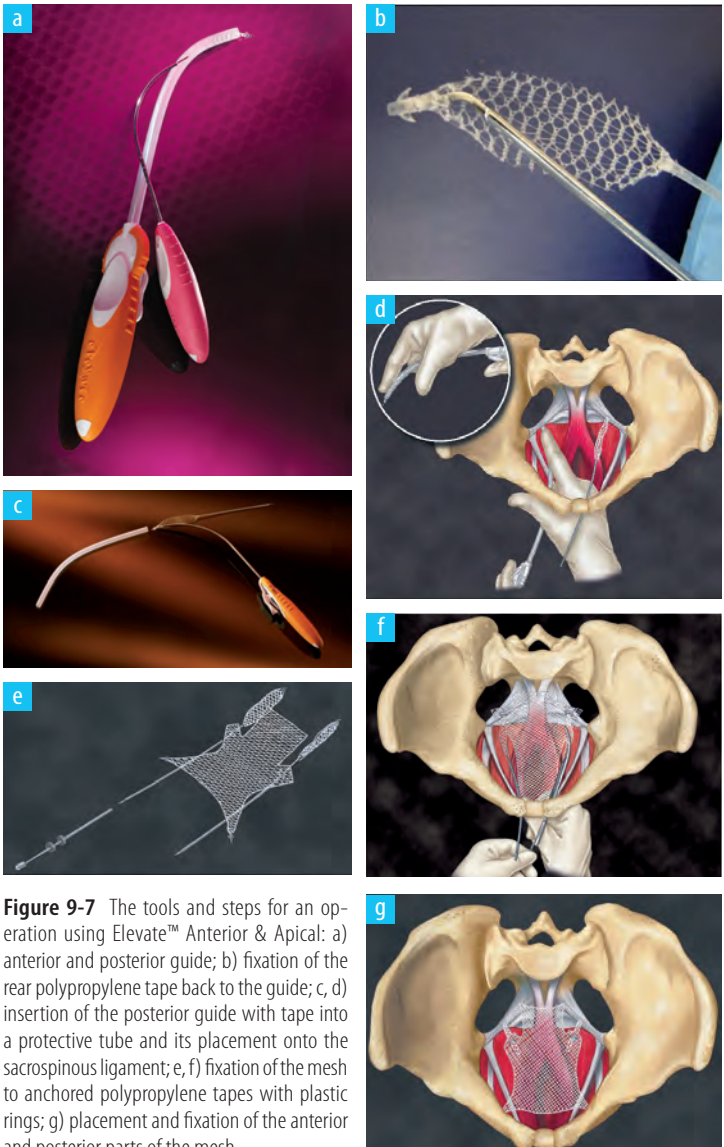


Figure 9-7 The tools and steps for an operation using Elevate™ Anterior & Apical: a) anterior and posterior guide; b) fixation of the rear polypropylene tape back to the guide; c, d) insertion of the posterior guide with tape into a protective tube and its placement onto the sacrospinous ligament; e, f) fixation of the mesh to anchored polypropylene tapes with plastic rings; g) placement and fixation of the anterior and posterior parts of the mesh.

11 PHARMACOTHERAPY

11.1 MEDICAL TREATMENT OF SUI

The prevalence of UI in women ranges between 25 and 40%. SUI is a passive leakage of urine through the urethra as a result of increased intra-abdominal pressure. It is generated by insufficiency of the locking mechanism of the urethra without simultaneous contraction of the detrusor muscle and affects approximately 50% of incontinent women. Treatment is indicated if incontinence interferes with the quality of life of patients and cannot be managed with frequent urination or decreased physical activity. There are several current treatment options for SUI, including exercising the pelvic floor muscles with the use of different aids, electrical stimulation, changing habits, surgical treatment, and the use of pads in the case of surgical failure. The aim of pharmacotherapy for SUI is to increase the intraurethral closing power. We can achieve this effect by increasing the tone of the smooth muscles or by influencing the tone of the cross-striated muscles of the urethra.

11.1.1 Options for Medical Treatment of SUI

The treatment of SUI in women is either surgical or conservative. Doctors usually recommend surgical treatment, which can be very successful. Some patients, especially those with mild UI, do not wish to undergo surgery. In addition, surgical treatment may be contraindicated in some physically or mentally disabled patients. Alpha$_1$-adrenergic agonists, which have been used with a variable effect in the treatment of SUI, often have undesirable effects such as tachycardia and hypertension.

11.1.2 The Urethra and Its Role in Maintaining Urinary Continence in Women

Innervation of the urethra involves sympathetic and parasympathetic as well as somatic nerves. Cross-striated muscle fibers of the urethra along with muscles of the pelvic floor provide continence at the level of the mid-urethra in stress conditions, i.e., with increased intra-abdominal and intravesical pressures. The main role of a cross-striated muscle is therefore immediate contraction during an increase in intra-abdominal pressure. Thus, it may be activated freely or through a reflex mechanism induced by bladder distension.

SYMPATHETIC NERVOUS SYSTEM

Alpha-adrenergic receptors predominate in the trigone area and proximal urethra. During their irritation, smooth muscle contraction and an increase in intraurethral pressure occur. According to some authors, the influence of vascular smooth muscle significantly contributes to the change in intraurethral pressure.

PARASYMPATHETIC NERVOUS SYSTEM

The bladder wall, which is composed of smooth muscle, contains mainly parasympathetic innervation. Stimulation of the pelvic nerve produces a rise in intravesical pressure and contributes to urethral relaxation during micturition.

11.1.3 Increase of Outflow Resistance in the Urethra

Several groups of medications are recommended to increase intraurethral pressure [1]. Their use, pharmacodynamics, and a list of side effects are described in detail below.

α-ADRENERGIC AGONISTS

Treatment with α-sympathomimetics stimulates contraction of the smooth muscles of the urethra. This treatment permanently increases urethral closing pressure during bladder filling and even during urination [2].

Ephedrine, phenylpropanolamine (PPA), midodrine, and *methoxamine* are some of the α-adrenergic agonists used in the treatment of SUI. *Ephedrine* and *PPA* directly stimulate adrenergic receptors α and β but may also release norepinephrine from adrenergic nerve terminals. Open and controlled clinical studies have proven that

11.2.2 Overview of the Most Commonly Used Medications in the Treatment of Urgency or Urge Incontinence (OAB)

Standard medication for the treatment of urgency or urge incontinence (OAB) includes anticholinergics, agents with mixed spasmolytic and parasympatholytic effects, β_3-sympathomimetics, tricyclic antidepressants and antidiuretics [16, 17].

ANTICHOLINERGICS

In addition to good effectiveness for OAB symptoms, antimuscarinics exhibit good safety and tolerability profiles. The medication tolerance, adherence, and persistence during long-term treatment are determined not only by efficacy but also the number of side effects and their clinical significance.

Trospium is a quaternary ammonium compound with reduced liposolubility in which the spasmolytic effect dominates. It is absorbed slowly and therefore must be administered on an empty stomach at least one hour before a meal. It is a competitive antagonist of acetylcholine for postsynaptic muscarinic receptors, particularly receptors M_1, M_2, and M_3, and thereby influences relaxation of the detrusor smooth muscle.

The advantage of *trospium* is that it only minimally crosses the blood-brain barrier, thus reducing the risk of central side effects including an influence on cognitive functions. Cytochrome P450 does not participate in the metabolism of *trospium*. Approximately 80% of the drug is eliminated in active form in the urine, thus locally inhibiting the bladder. We can explain the local effects of *trospium* by the high concentration of urothelial muscarinic receptors and their inhibitory effects on afferent sensory nerve activity and the activity of the smooth muscle of the bladder. Its biological half-life is between five and 15 hours. Peak serum levels are reached in five to six hours in young healthy volunteers and in approximately three and half hours in elderly healthy volunteers. The recommended dosage is 15 mg twice a day. The daily dosage may be increased to 45 mg or higher, but it should be divided into three doses. It has considerably fewer side effects than *oxybutynin*.

Darifenacin is a highly selective antagonist of the M_3 receptor; it has an affinity for this receptor that is five times higher than for

the M_1 receptor. A study by Haab showed that the most common side effects of this product are dry mouth and constipation [18]. The recommended dosage is 7.5 to 15 mg a day.

Solifenacin is a competitive antagonist of cholinergic receptors M_2, and M_3, with a higher selectivity for the bladder than for the salivary glands [19]. It is effective in the treatment of OAB symptoms with a lower incidence of dry mouth. After oral administration, *solifenacin* is well absorbed. Its bioavailability is approximately 90%. The maximum plasma concentration is achieved within three to eight hours after administration. It is metabolized primarily in the liver, mainly via cytochrome complex CYP3A41. Ingested food has no effect on the pharmacokinetics of this product after oral administration. In patients with mild to moderate renal dysfunction or in patients with mild hepatic dysfunction, no dosage adjustments are necessary. Patients with severe renal dysfunction or moderate hepatic dysfunction should not take more than 5 mg once per day under strict monitoring. Side effects may rarely include double vision, constipation, or dry mouth. The recommended dosage is 5 to 10 mg once a day. One advantage of this medication is the possibility of a dosage increase, as the dose can be increased from 5 mg once a day to 10 mg once a day. If other potent inhibitors of cytochrome complex CYP3A41 are taken concurrently with this product, the maximum daily dosage should be reduced to 5 mg. Administration of *solifenacin* is contraindicated in patients with urinary retention, severe gastrointestinal illnesses, myasthenia gravis, or in women with narrow-angle glaucoma. Other studies suggest that an age-related dosage adjustment is not necessary and that treatment with this medicine does not cause urinary retention [20]. The STAR study included 1,355 patients in 17 countries. It demonstrated that after treatment with *solifenacin,* 74% of the patients experienced at least a 50% reduction in incontinence episodes. Almost 59% of all patients were fully continent. The SUNRISE study compared the effect of 5 mg and 10 mg dosages of *solifenacin* with the placebo effect in the treatment of OAB. The results conclusively demonstrated the benefit of this medication in the treatment of urgency. At a daily dosage of 5 mg, only 12.2% of the patients reported dry mouth, while 5% suffered constipation. We can explain this outcome by

the greater selectivity of *solifenacin* for the bladder. In women who received placebo, the prevalence of reported dry mouth was 2.7 % and that of constipation was 5 %. After an eight-week treatment, the therapeutic dosage increased in approximately 50% of women who received *solifenacin* but also in women who received placebo.

Fesoterodine is a competitive specific antagonist of muscarinic receptors. It is rapidly hydrolyzed by non-specific plasma esterases into a 5-hydroxymethyl derivative, which is a major pharmacologically active metabolite. The active metabolite is further metabolized in the liver by CYP2D6 and CYP3A4 into pharmacologically inactive metabolites. The recommended initial dosage is 4 mg once per day. According to the individual response, the dosage may be increased to 8 mg once per day. The full treatment effect appears within two to eight weeks. *Fesoterodine* can cause mild to moderate antimuscarinic effects such as dry mouth, constipation, dizziness, headache, and other problems. We can expect an increased risk of side effects in patients with hepatic or renal insufficiency.

This group also includes *tolterodine*, which mainly acts on receptors M_2, M_3, and M_4. In women with OAB, this product demonstrated a significant and lasting effect on the bladder. Its influence on the salivary glands and other side effects of the medication are minor [21]. The M_3 receptor is the main target in the treatment of OAB. However, targeting the M_2 receptor in the bladder applies mainly to denervated hypertrophic bladders. *Tolterodine* has an eightfold lower affinity for muscarinic receptors in the parotid gland than *oxybutynin* [22]. It is completely absorbed from the gastrointestinal tract. The half-life in the circulation ranges between two and three hours, and it is metabolized in the liver into the active metabolite (DDO1), which has properties similar to those of *tolterodine. Tolterodine IR* (immediate-release) is most often prescribed at a dosage of 2 mg twice a day. We can observe the effect of treatment after four weeks, and the maximum effect within five to eight weeks. Many double-blind, placebo-controlled studies in women with OAB have indicated a reduction of incontinence episodes and urinary frequency [23]. Comparative studies with *oxybutynin* have mainly indicated a statistically significantly lower incidence of dry mouth [24]. An even better effect and a faster onset of action were achieved with

tolterodine ER, which has a slow-release active ingredient. *Tolterodine ER* is approximately 18% more effective than *tolterodine IR* and has a lower rate of dry mouth.

Other medications in this class, such as *propantheline* or *emepronium*, are no longer in use for the treatment of urge incontinence.

MEDICATIONS WITH MIXED SPASMOLYTIC AND PARASYMPATHOLYTIC EFFECTS

Oxybutynin is usually administered orally at a dosage of 5 mg twice a day. At the beginning of treatment, we must evaluate the medication tolerability by the patient or the occurrence of side effects and then adjust the dosage. This medication acts as a local anesthetic, has a direct myorelaxing effect, and acts as a parasympatholytic. Common side effects include dry mouth, constipation, visual disorders, and fatigue. Treatment with an immediate release (IR) formulation is less expensive. Unfortunately, this product does not specifically target the genitourinary tract. Therefore, this medication produces systemic reactions that cause side effects. Side effects are minor if the total daily therapeutic dosage does not exceed 5 mg (2.5 mg twice a day). The new favored extended-release (ER) form of *oxybutynin* guarantees 24-hour efficacy in one daily dose (5, 10, or 15 mg once a day, orally). Compared to the older form of *oxybutynin*, the bioavailability of the XL formulation is higher. This form significantly reduces episodes of urinary leakage and slightly reduces the side effects of the medication. Similar results in the treatment of OAB and urge incontinence are also reported in treatment with the transdermal (TD) form of *oxybutynin*. Controlled studies show that the TD form of *oxybutynin* has the same therapeutic effect as *oxybutynin IR*. The TD form has a lower incidence of adverse events but may cause a local reaction. The effectiveness of *oxybutynin* is well documented, although its clinical use is often limited by side effects. Other methods and forms of the medication, namely TD and XL, lead to a reduced incidence of side effects.

Propiverine is another substance that acts as a parasympatholytic and calcium channel blocker. The recommended dosage is 15 mg twice a day orally. It causes a number of side effects due to its anticholinergic properties. In a study, dry mouth occurred in 37% of examined women, compared with 8% of the women who received placebo.

RISKS ASSOCIATED WITH THE USE OF ANTIMUSCARINICS BY THE ELDERLY

- Physiologically decreased production of acetylcholine in the CNS associated with a gradual loss of cholinergic neurons and other neurotransmitters, causing increased sensitivity of the CNS to medications with anticholinergic effects.
- Higher incidence of CNS disorders, in particular cerebrovascular and neurodegenerative disorders such as Parkinson's disease or Alzheimer's dementia.
- Polypharmacotherapy, although some medicines may have an anticholinergic effect, resulting in potentiation of the anticholinergic effect during their use.

In elderly patients, studies have confirmed that treatment with anticholinergically active medications can result in a decline in memory function and aggravation of dementia [25]. The ability of antimuscarinics to affect the CNS depends on the penetration of the medication into the CNS, binding to muscarinic receptors in the CNS, and the degree of influence on neurotransmission.

Antimuscarinics differ in their ability to cross the blood-brain barrier (BBB) and undergo active removal from the CNS. A smaller molecular weight of the medication, ionic charge, and lipophilicity facilitate passive crossing of the BBB into the CNS. The P-glycoprotein transport system facilitates the active removal of some medications, such as *trospium chloride, darifenacin*, and *fesoterodine*, through the BBB from the CNS. Some antimuscarinics, such as *oxybutynin*, *solifenacin*, and *tolterodine,* are not removed from the CNS by active transport and thus achieve higher concentrations in the CNS.

The association of antimuscarinics with individual subtypes of muscarinic receptors in the CNS interferes with cholinergic transmission. The muscarinic receptor subtypes M_1 and probably M_2 and M_4 are involved in cognitive processes. The most important, however, is the link to the M_1 receptor. Therefore, antimuscarinics that are highly selective for the M_3 receptor, such as *solifenacin* and *darifenacin*, cause fewer central side effects.

β_3-SYMPATHOMIMETICS

Mirabegron is a representative of a new class of medications for the treatment of OAB. It is an active, selective agonist of β_3-adrenergic receptors. It reduces the frequency of detrusor contractions during the filling phase without affecting the amplitude of the bladder contractions during urination.

In large phase III studies, *mirabegron* demonstrated marked effectiveness for OAB symptoms. It was also associated with a significant reduction in the number of episodes of urgency, urge incontinence, and urinary frequency [26, 27, 28]. *Mirabegron* does not block muscarinic receptors in the brain and thus does not affect cognitive function. Therefore, it may be given to patients with Alzheimer's disease who suffer from OAB symptoms. Treatment of OAB with *mirabegron* also led to a significant improvement in quality of life parameters in patients. There are few side effects of this medication, and they most often occur after the administration of 50 mg *mirabegron.* Problems such as tachycardia, hypertension, nasopharyngitis, and headache are very rare. The incidence of dry mouth in patients receiving *mirabegron* was three times lower, namely 2.8% versus 8.6% compared with *tolterodine* 4 mg SR. Studies have confirmed the long-term safety and good tolerability of *mirabegron*. The effectiveness of *mirabegron* in the long-term monitoring of basic symptoms of OAB (urgency and urge incontinence) was already evident after the first four weeks of treatment. This effectiveness was apparent both in women who were previously treated with parasympatholytics and in those for whom it was deployed as the drug of first choice. The efficacy further increased during the twelve-month duration of therapy. The recommended dosage is 50 mg once a day. In patients with renal and hepatic insufficiency, the recommended dosage is 25 mg once a day.

TRICYCLIC ANTIDEPRESSANTS

Imipramine is administered in increasing dosages. We usually begin with 25 mg nightly and increase the dosage until an effect is noted or side effects develop. The dosage is then 25 mg two to three times a day. Side effects, such as fatigue, weakness, orthostatic hypotension, and arrhythmia, among others, may also occur

12 MISTAKES AND ERRORS IN MEDICAL TREATMENT OF URINARY INCONTINENCE

The basic requirement for the proper choice of medication for UI in women is to correctly diagnose the type of incontinence. It is vital to distinguish the stress and urge forms of incontinence. If the diagnosis is incorrect, then the medication will have no effect, and the patient's condition may worsen. For example, we may misdiagnose the stress type of incontinence for the urge type in a patient with SUI and cystocele. The subsequent use of treatment with parasympatholytics may cause difficult urination, even urinary retention, followed by the development of urinary tract infection. Conversely, we may treat urge incontinence with medications that tone the urethra. These medications are α-mimetics or agents that increase the tone of the cross-striated muscles of the urethra and pelvic floor. This treatment can improve the condition of the patient if the cause of urgency is an unstable urethra. However, if the cause is in the bladder and we fail to find it, this type of treatment will not have an effect and may even cause side effects. In the worst case, a patient with an urge incontinence might be recommended to undergo surgery, and her condition could worsen. In the case of a mixed UI, the cause of urgency might be a cystocele. This condition causes high residual urine volume and leads to recurrent urinary tract infections that cause urgency, and surgical treatment may be recommended. A surgical solution leads to the correction of anatomical conditions, and the treatment can be then completed with medication.

When using medication for both stress and urge UI or in OAB, we must start with a smaller dosage. Later, the dose may gradually be increased until we achieve a therapeutic effect while carefully monitoring potential side effects. Should these occur, it is necessary to assess the type and degree of problems and to decide whether the

treatment should be stopped immediately. Alternatively, the medication dosage may be reduced and the treatment continued. If the treatment has no effect or significant side effects complicate the daily life of the patient, then the medication must be changed and its therapeutic and side effects re-evaluated. Patients must benefit from the medication treatment and must notice significant changes in the assessment of their problems. An effective treatment for stress UI occurs when, after three months of treatment with continuous medication, the patient notices at least a 50% decrease in the frequency of episodes of involuntary urine leakage during the week before a checkup.

For the urgent type of UI or OAB, an inadequate effect means a decrease in the frequency of episodes of UI or urgency by less than 50% and in the number of micturitions by less than 20%. After two to three months, we evaluate the condition of patients and the effectiveness of the treatment, which is continued only if the effect is proven. If the medication has a good effect after three months, it is necessary to continue the treatment for at least three to six months. This approach improves the effectiveness of the treatment and increases the chance of a durable therapeutic effect after medication is stopped. Evaluation of the treatment effect must also consider the financial cost to the patient and to society.

SUMMARY

The aim of our publication is to provide the reader with a summary of the anatomy of the lower urinary tract and pelvic floor, to outline the physiology and pathophysiology of urination and continence, and to define individual terms. We review individual types of incontinence in women and their causes and describe the individual examination methods most frequently used in urogynecology. Subsequently, we summarize the surgical methods used to treat UI, as well as procedures to address pelvic floor defects in women. A separate chapter addresses the use of foreign implantation materials in pelvic floor reconstruction surgery, with an emphasis on selected procedures. For all of the surgical methods, we describe the technique of the procedure, evaluate possible peri- and postoperative complications, and indicate the success rate of the surgery. Next, we provide answers to frequently asked questions regarding SUI and the descent of pelvic organs. In another chapter, we address the pharmacotherapy of urinary stress incontinence and the treatment of OAB. As a final point, we identify the most frequent errors in the pharmaceutical treatment of UI.

ABOUT THE AUTHORS

Prof. Alois Martan, M.D., D.Sc. (born 1952) studied at Faculty of General Medicine, Charles University, Prague. After graduation in 1977, he worked as an intern at Vinohrady University Hospital, Department of Gynecology and Obstetrics and after one year, moved to the First Gynecology and Obstetrics Department of Charles University in Prague, headed by Professor Papež. He became an assistant professor in 1992, and an associate professor in 1995 after a successful defense of his habilitation thesis "Modern diagnosis and conservative treatment of urinary incontinence in women." In 2001, Prof. Martan was awarded the academic degree of Doctor of Medical Sciences after a successful defense of the thesis "Ultrasound examination of the lower urinary tract in women." In 2003, he was appointed professor of gynecology and obstetrics and has served as head of the Department of Gynecology and Obstetrics, First Medical Faculty and General University Hospital, Charles University in Prague since 2004.

Prof. Martan has authored or co-authored nearly 900 lectures, posters, abstracts, and publications at home and abroad. He has been a researcher and co-researcher on eleven grant projects.

Prof. Martan has won numerous awards for his work: in 2002, Pawlik Award for the best work in the field of gynecology and obstetrics and Minister of Health Award for an exceptionally successful research project; in 2003, Organon Award for the best publication in urogynecology for years 2001 to 2003; in 2005, Award of

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Prof. Martan is a committee member of the Czech Gynecological and Obstetrical Society JEP, vice chairman of the Committee of the Urogynecological Society and Section, International Continence Society (ICS), International Urogynecological Association (IUGA), member of the editorial board of the information and educational server Gynstart, a member of the Academic Senate of the First Faculty of Medicine of Charles University, Prague and a member of the Dean's Committee, chairman of the grant committee IGA for gynecology and obstetrics, and AK Czech Ministry of Health, among others.

Prof. Martan has completed a number of internships abroad during his many years of practice. In 1986 and 1987, he was head of the Gynecology and Obstetrics Department of a hospital in Phnom Penh, Cambodia. In 1991, Prof. Martan completed an internship in Saint George's Hospital in London. For many years, he has been working with university gynecological and obstetrical facilities throughout Europe, especially in Germany, such as in Jena, Frankfurt, and Munich.

In 1994, he was general secretary of the ICS Congress in Prague, in 1995, a member of the preparatory committee of the National Gynecology and Obstetrics Conference held in Prague, and in 2007, the president of the National Conference of Gynecology and Obstetrics CGPS, also held in Prague. Prof. Martan is the coordinator and organizer of regular urogynecological graduate courses, with international participation, at the First Medical Department of Charles

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He passed the first postgraduate certification (Certification of I. degree, specialization gynecology and obstetrics) in 1996 and the second in 2000 (Certification of II. degree, specialization gynecology and obstetrics), in 2010 – Subspecialization in Urogynecology.

In 2001, he defended his dissertation "Urogenital Chlamydia infection, its consequences, diagnosis, and treatment." In 1997, he was an intern at University of Münster, Germany.

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Kamil Švabík, M.D., Ph.D. (born 1972) graduated from the First Medical Faculty, Charles University in Prague in 1997 and during his studies, completed a number of internships abroad. In 1998, he joined the Department of Gynecology and Obstetrics Department of Masaryk Hospital in Ústí nad Labem as an intern. After one year, in 1999, he transferred to the Department of Gynecology and Obstetrics, First Medical Faculty, Charles University in Prague, where he has been since. In 2002, he became a member of the urogynecological group of Gynecology and Obstetrics Clinic, which is involved in grant projects. Dr. Švabík lectures at international congresses with a urogynecological focus, such as IUGA, ICS, and EUGA. He earned his PhD in 2011.

Dr. Švabík received the Sonek Award In 2012. He publishes in several foreign journals, for which he also serves as a reviewer. He is one of leading Czech specialists in reconstructive surgery of the pelvic floor and lower urinary tract infections in women. He is a member of the Research and Development Committee of IUGA and is also involved in numerous international projects.

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