SURGICAL AND RELATED INTERVENTIONAL TREATMENT

Part of "32 - BENIGN PROSTATIC HYPERPLASIA"

Selection of Operative Approach

The term *operative approach* is used here in the broadest sense to include tissue excisional and destructive as well as incisional and other procedures that modify prostate, bladder neck, or urethral relationships without or with alteration in tissue mass. Success in these endeavors depends on identifying BPH as the cause of dysfunctional voiding correctly; recognizing the changes in BPH configuration or mass that have a high probability of correcting or modifying the dysfunctional voiding; identifying alternative approaches to accomplish this goal; and objectively assessing the achievable degree and duration of improvements in voiding and the risk involved to achieve them. In addition, the physical, emotional, and monetary costs are important considerations. Risks of failure to pursue and accomplish an effective treatment require delineation. The discussion of individual approaches in this section represents a combination of reported observations and personal judgments regarding treatment alternatives available.

Physical Intervention

Physical intervention procedures to alter BPH voiding dysfunction have traditionally centered on removal of the hyperplastic, usually adenomatous, growth by open or transurethral surgical excision (Fig. 32.28). Recently, alternative approaches including transurethral incision, laser “prostatectomy,” needle ablation, interstitial laser treatment, and electrovaporization, as well as transurethral thermotherapy, high-intensity focused ultrasound, and balloon dilation, have been used for this purpose. Most of these latter maneuvers, so-called minimally invasive alternative treatments, are usually restricted to glands of limited size without significant median lobe development. Their current status is discussed briefly.

FIGURE 32.28. Traditional surgical approaches for the treatment of benign prostatic hypertrophy. [From Grayhack JT, Sadlowski RW. Results of surgical treatment of benign prostatic hyperplasia. In: Grayhack JT, Wilson JD, Scherbendke MJ, eds. *Benign prostatic hyperplasia, NIMADD workshops proceedings, Feb 20–21, 1975.* US Department of Health, Education and Welfare pub no (NIH) 76-1113, 1976, with permission.]

Surgical Treatment

The goals of surgical treatment of BPH voiding dysfunction are to correct significant pathophysiologic effects of bladder neck obstruction (i.e., renal failure, stone formation, and possibly infection) and to improve the quality of the patient's life by allowing him to void to completion at normal intervals with an excellent urinary stream while retaining good urinary control and unaltered sexual function. The treatment approach that allows these patient-prioritized goals to be reached with the least risk of morbidity and disability should be chosen. The patient's general condition, the size and configuration of obstructing prostatic tissue, the functional status of the bladder, the surgeon's skills, and the patient's preference warrant careful consideration as a so-called prostatectomy is planned.

Preoperative Preparation

Careful assessment of the patient's general and genitourinary status is essential to establish a proper diagnosis and plan appropriate therapy. Prostatectomy is an elective procedure. Even in the patient with the most severe degree of bladder neck obstruction and its anatomic sequelae, the obstruction can be adequately relieved by catheter drainage while the patient's condition is optimized before definitive therapy. Adoption of this concept has played a major role in reducing mortality and morbidity rates of surgical treatment of BPH. Every aspect of the surgical approach to the treatment of BPH has improved, including preoperative assessment, performance of the procedure, and the postoperative management (216). Consequently, the outcomes have been preserved or improved despite the numerically decreased experience of individual urologists (38,153,216,389).

Systemic Considerations

The elderly patient with BPH often has cardiovascular, pulmonary, neurologic, or other abnormalities that affect the choice of and preparation for a therapeutic approach, as well as the anesthetic used. Patients with chronic obstructive pulmonary or valvular or ischemic heart disease may require sophisticated evaluation to provide baseline information, focus preoperative management, and help select the optimal anesthetic approach. Drug allergies and use of drugs that affect coagulation, particularly aspirin or antiinflammatory

P.1438

agents, should be noted. The status of the veins of the patient's lower extremity warrants attention, as does the integrity of the coagulation mechanism. The risk of postoperative deep vein thrombus (DVT) and pulmonary emboli deserves special mention. Urologic patients contribute significantly to the group of postsurgical patients prone to DVT (20% to 40%) and embolic phenomena (25,65,260). In patients not given prophylactic medication, the incidence of DVT with TURP is 10% (26). Prophylactic measures such as adequate hydration, early ambulation, and use of extrinsic soleal compression of the extremities are advised. High-risk patients such as those with lower extremity venous disease, heart disease such as atrial fibrillation or myocardial infarct, history of malignancy, obesity, or immobility deserve consideration of more aggressive approaches. Intermittent pneumatic compression, our preferred prophylactic measure, appears to reduce risk of lower extremity deep vein thrombophlebitis. Use of heparin at a dose of 5,000 units every 8 hours reduces the incidence of fatal pulmonary embolism without seeming to predispose to major perioperative hemorrhage; however, the incidence of nonfatal wound hematomas increases slightly. Although the efficacy and safety of drug-induced anticoagulation in urologic surgical patients has been questioned (56,368) and is rarely used by us, formal anticoagulation deserves consideration in selected patients at high risk. The use of low-molecular-weight heparin (dalteparin) and dextran have been shown to slightly increase blood loss with TURP (155). The use of other low-molecular-weight heparin agents such as enoxaparin (Lovenox) in this setting has not been reported and is not used routinely in our hands.

Genitourinary Considerations

Renal failure resulting from bladder neck obstruction caused by BPH is often reversible, but unpredictably so. Catheter drainage of the bladder usually relieves the obstruction and results in maximum renal functional improvement. Sarmina and Resnick (317) listed characteristics of patients with obstructive uropathy caused by BPH that are more likely to exhibit irreversible renal dysfunction. This “at-risk” patient profile includes bladder neck obstructive symptoms for more than 1 year; a history of marked enuresis or renal insufficiency; antecedent urinary tract infection; palpable bladder or urinary retention; creatinine clearance of less than 20 mL per minute at hospitalization; and decreased cortical thickness or increased echogenicity on renal ultrasonography. The possibility of postobstructive diuresis resulting in significant hypovolemia following catheterization of these elderly patients exists and must be monitored. This phenomenon is primarily induced by osmotic load but can be associated with some degree of renal tubular dysfunction (114). Fluid administration should be regulated by monitoring urine output, supine and erect blood pressure and pulse rate, serum electrolytes, and creatinine and blood urea nitrogen levels. Excessive fluid replacement can lead to a spiraling fluid intake/urine output phenomenon. Catheter drainage should be maintained until renal functional status has improved sufficiently to restore creatinine and electrolyte blood levels to normal or to stabilize abnormal values. Failure of renal function to improve should signal consideration of suboptimal bladder catheter drainage or supravesical obstruction. Persistent significant azotemia predisposes to platelet dysfunction and bleeding that is often at least partially reversible by presurgical dialysis and by administration of antidiuretic hormone analogue L-desamino-8-D-arginine vasopressin (DDAVP). Renal functional status significantly affects appropriate anesthetic and pharmacologic management in these patients.

Sepsis has been a major contributor to infrequent mortality after transurethral resection (240). Bacteremia occurs postoperatively in 10% to 32% of patients without recognized preoperative bacteriuria (158) and much more frequently in patients with infected urine (68,250). Appropriately timed initiation of antibiotic therapy selected on the basis of *in vitro* culture findings is an accepted and effective presurgical practice in the latter patients. However, prophylactic antibiotic administration to reduce immediate and long-term infection-related risks in patients without preoperatively documented urinary infection has a limited effect on perioperative infections or fever (158), although reduction in the incidence of postoperative bacteremia has been noted (187). Because as many as 20% of prostatectomy tissue specimens harbor demonstrable bacteria (120), antibiotics used for prophylaxis should ideally provide bactericidal tissue as well as urine levels. A recent study using ciprofloxacin 500 mg orally or parenteral cefotaxime demonstrated results that were comparable with but not significantly superior to placebo in achieving satisfactory bacterial prophylaxis (187). Currently, empiric 24-hour intravenous (IV) or intramuscular (IM) antibiotic prophylaxis has become common in prostatectomy patients because of the practice of admission on the day of surgery and rapid postoperative discharge. Patients with increased risk factors for infection such as azotemia, upper tract calculi and other significant abnormalities, significant residual urine, debility and immunocompromised states, and diabetes mellitus are maintained on longer-term oral antibiotic prophylaxis.

Antibiotic prophylaxis is indicated at the time of prostatic surgery or endoscopic urinary tract manipulations such as cystoscopy or urethral dilation in patients who have an increased risk of infection from transient bacteremia because of local organ pathology or prosthesis. The American Heart Association recommends endocarditis prophylaxis for patients with prosthetic cardiac valves (including porcine valves), most congenital cardiac malformations, surgically constructed systemic-pulmonary shunts, rheumatic and other acquired valvular dysfunction, idiopathic hypertrophic cardiomyopathy, a history of bacterial endocarditis, mitral valve prolapse with regurgitation or thickened leaflets,

P.1439

or recent (6 months) cardiac surgery. Enterococci are the most common cause of endocarditis after gastrointestinal and genitourinary procedures. A standard parenteral regimen of antibiotic prophylaxis for genitourinary surgery and instrumentation consists of 2.0 g of ampicillin (50 mg/kg) IM or IV plus 1.5 mg/kg of gentamicin to a maximum of 120 mg administered within 30 minutes of starting the procedure. Ampicillin 1 g IM or IV or 1 g of amoxicillin orally should be administered 6 hours later for high-risk patients. Moderate-risk patients can be treated with 2 g of amoxicillin orally 1 hour before or 2 g of ampicillin IM or IV within 30 minutes of the planned procedure. In penicillin-allergic patients, vancomycin is substituted for ampicillin (1 g IV infused slowly over 1 hour beginning 1 hour before surgery). High-risk patients include individuals with prosthetic heart valves or a history of endocarditis and those taking continuous oral penicillin for rheumatic fever prophylaxis (357).

Other Considerations

Compared with the 12.5% mean requirement for blood transfusion in patients with TURP and the 35% for patients with open prostatectomy cited in the BPH clinical practice guidelines (230), transfusions are currently rarely required in patients subjected to prostatectomy. Transfusion rates below 1% are now commonly quoted in the literature (186). In a survey of 3,885 patients from 13 institutions, almost all undergoing transurethral prostatectomy between 1980 and 1987, 2.5% required blood during the operation and 3.9% required it in the postoperative period (240). The decreased size of adenomatous tissue removed (256) and the improved preoperative preparation, instrumentation, and anesthetic and surgical techniques all probably contribute to lessen blood loss (112,186). Greene (135) estimated a blood loss of approximately 9.5 mL/g of tissue resected. Blood typing, matching, or consideration of use of autologous blood is used only selectively in our hands. Finasteride use preoperatively has further reduced need for transfusion (143).

Operative Approach

The decision of whether the patient will benefit appreciably from surgical treatment of BPH should be made by a critical evaluation of his symptoms and findings. Once made, selection of appropriate therapy to maximize benefit and minimize risk is necessary. Historically, incompletely removed gross BPH tissue has been associated with failure to correct or early recurrence of BPH-related voiding dysfunction. This failure was frequently corrected by removal of additional tissue. Consequently, the goal to remove BPH tissue completely became an accepted dictum. The results with antiandrogenic and limited interventional therapy, especially when followed by procedures that remove the residual gross BPH, provide further support for this idealized goal. The choices to achieve complete excision of BPH have been open prostatectomy by a variety of anatomic approaches or transurethral resection or its surrogates (Fig. 32.28). Alternative mechanical approaches such as interstitial laser and transurethral microwave thermotherapy are being used selectively with variable immediate and long-term successes. In selecting an appropriate approach for a patient, several factors warrant consideration, including the size and configuration of the adenoma, the presence of other bladder or prostatic pathology such as diverticula or stones, the presence of complicating abnormalities such as fusion or ankylosis of the joints of the lower extremities, a large scrotal hernia, a rigid penile prosthesis, multiple urethral strictures, the skill and experience of the surgeon, and the expectations and prejudices of the patient. Selective use of interventional approaches reduces the risk of procedures and increases the likelihood of achieving a good result. Urologic surgeons should be skilled in a variety of operative techniques to relieve bladder neck obstruction caused by BPH and should use them with objectively identified goals.

Transurethral Resection of the Prostate

Anesthetic Considerations

Restall and Faust (296) cited a variety of reasons regional anesthesia in the form of a spinal or subarachnoid block is highly desirable in patients undergoing transurethral prostatic surgery. Excellent skeletal and smooth muscle relaxation allows easy filling of the bladder and reduces bladder spasms. Bladder perforation, water intoxication, and congestive heart failure are best perceived early by maintaining verbal contact with the awake patient. Airway-related complications (unexpected coughing, gagging, or bucking) are largely avoided with regional anesthesia, and a comfortable, quiescent patient aids in providing hemostasis (232,262). The presence of documented central or peripheral neurologic deficits, potential bleeding tendencies, chronic low back pain, osseous metastases, and lack of patient acceptance weigh against the use of regional anesthesia (37).

Urologists should be aware of the risk of hypotension and postspinal headache associated with subarachnoid block (296). Significant hypotension, usually responsive to additional crystalloid or α-adrenergic agonist administration, can result from the chemical sympathectomy extending to four dermatomes higher than the apparent sensory level. Risk of myocardial infarction is not substantially different in these patients with coronary artery disease with either spinal or general anesthesia. A postspinal headache, which is usually occipital and characteristically relieved by recumbency, is produced by the sustained transdural leakage of cerebrospinal

P.1440

fluid. If necessary, this can be controlled by use of an epidural patch of autologous blood (72).

Steps Preliminary to Resection

Before the technique of endoscopic resection is discussed, prophylactic vasectomy, management of the urethra, cystoscopy before resection, and the choice and preparation of the resectoscope deserve brief consideration.

The reported 0.2% incidence of epididymitis by Mebust and colleagues (240) in 3,885 patients, only 10% of whom had had a vasectomy, reflects the currently diminished incidence of this complication. Nevertheless, prophylactic vasectomy effectively diminishes the risk of epididymitis (124) and warrants consideration in high-risk individuals with a chronic urinary tract infection, history of prolonged catheter use, previous epididymitis, or increased systemic or local risk factors for infection.

Urethral stricture, reported in 1.5% to 20% of patients after TURP, can be caused by urethral trauma from the resectoscope, catheter, or bacterial infection (148,149,161,393). Emmett and associates (85) found that the external urethral meatus and fossa navicularis of only 62% of men calibrated to 28 Fr or greater; in addition, the anterior urethra calibrated to 24 or 26 Fr in 9%. These sites of natural narrowing of the male urethra affect the selection of an appropriately sized resectoscope sheath. Calibration of the meatus–fossa navicularis and visual inspection of the urethra on insertion of the cystoscope are used to guide this selection. Gentle, progressive, manual dilation will usually allow introduction of the well-lubricated resectoscope sheath. Consideration of prolonged (2 weeks) administration of antibiotics to reduce the rate and severity of postresection stricture is worthwhile (149). A dense, narrow, external meatal or fossa navicularis stricture is best managed by a ventrally or dorsally placed meatotomy (Fig. 32.29). We prefer the latter to prevent a distorted urinary stream postoperatively.

FIGURE 32.29. The technique of urethral meatotomy. Insertion of a bougie into the fossa navicularis facilitates the incision **(A);** placement of continuous approximating hemostatic sutures **(B).** When performed in the ventral aspect of the meatus, significant spraying on urination will often be reported by the patient. This may be obviated by creation of a frenular skin flap **(C–E)** or by performing the initial incision on the dorsal aspect of the meatus. (From Thompson IM. Transurethral surgery. In: Glenn JF, ed. *Urologic surgery,* ed 2. New York: Harper & Row, 1975, with permission.)

Impassable or dense strictures of the distal urethra can often easily be incised at the 12 o'clock position with the direct-vision optical urethrotome by the use of a stenting ureteral catheter as a guide. Their presence may prompt reevaluation of the diagnosis. A perineal urethrostomy may be required if the entire urethra is significantly narrow, in the presence of severe ankylosis of the hip, or in patients with an excessively long (whether naturally or prosthesis produced) penis (Fig. 32.30). Stay sutures incorporating skin and urethral edges serve to provide repetitive access to the urethra. At the conclusion of the endoscopic resection, suture reapproximation of the urethra is generally not required if the urethral catheter is passed in the standard fashion. The skin can be approximated loosely with interrupted absorbable suture material.

FIGURE 32.30. Technique of perirenal urethrostomy. A Van Buren sound is used to create an accentuated projection of the bulbous urethra in the midperineum **(A).** A 2- to 3-cm vertical incision is then made down to and through the exposed urethral segment **(B).** Stay sutures facilitate exposure of the urethral lumen and ensure reentry capability should that prove necessary **(C**, **D).** Following completion of the procedure and insertion of the catheter, the urethra may be loosely reapproximated followed by skin closure **(E, F).** (From Thompson IM. Transurethral surgery. In: Glenn JF, ed. *Urologic surgery,* ed 2. New York: Harper & Row, 1975, with permission.)

Cystourethroscopy should precede the resection. Use of a complementary rigid lens system or flexible cystoscope with either direct or video monitoring permits complete evaluation of the urethra and bladder. Passage of the cystoscope under direct vision maximizes the opportunity to recognize urethral pathology and minimizes urethral trauma. Each centimeter increase in the normal 2.5 cm prostate ureteral length from the verumontanum to the vesical neck has been equated with approximately 10 g of

P.1441

additional prostate weight. The visual anteroposterior distance of the prostatic urethra, the depth and angle of the posterior lateral (5 and 7 o'clock) and anterior (12 o'clock) tissue clefts, the thickness of the prostate on digital examination with the endoscope in place, and the configuration of the prostatic hyperplasia including evidence of subtrigonal extension are useful to estimate the size of the prostatic adenoma and to evaluate the appropriateness of therapeutic alternatives. However, the most accurate method to estimate prostate size is a transrectal ultrasound measuring both total and transitional zone volume. Clefting of the bladder neck is important in differentiating a median lobe and median bar. The relationship of the prostatic hyperplasia to the ureteral orifices, verumontanum, and external urethral sphincter should be noted.

The presence of tumors, unexplained patchy inflammatory changes, calculi, trabeculation, and diverticula should be noted (Fig. 32.26). If identification of the ureteral orifices is difficult, IV administration of methylene blue or indigo carmine may assist in their visualization. Bladder diverticula should be assessed as to number, size, location, and probable emptying ability. An unsuspected pathologic finding may require reevaluation of the planned surgical procedure.

Before the rectoscope is inserted, it should be assembled to make certain all elements are appropriately fitted and working. The resectoscope sheath with deflecting (Timberlake) obturator in place is usually easily passed into the bladder. If a problem is encountered, insertion of the resectoscope may be accomplished under direct vision. If false passages or the prostate configuration make insertion particularly difficult, an endourologic guide-wire system or a small-diameter urethral catheter guide may be helpful in passing the resectoscope sheath into the bladder.

Various working elements, including a rack-and-pinion gear and a spring-activated mechanism, are available to control the movement of the cutting loop. We prefer the spring-mechanism instruments because of their “one-handed” operation. This permits insertion of the index finger of the free hand into the rectum to elevate the prostatic floor and facilitate the resection, particularly of the apical tissue. Many urologists prefer the video camera hookup and the lens eyepiece when performing TURP. In doing so, they watch the video screen for visual monitoring. Advantages of this technique are many, including a more comfortable upright position and keeping one's face away from resectoscope efflux. Potential disadvantages include a brief learning curve, reduced visual field, a reluctance to use rectal manipulation via the O'Conor drape to aid resection of the apex and other elusive sites, and the additional bulk of the resectoscope apparatus. Some urologists prefer instruments that permit continuous flow of irrigating fluid or insertion of a suprapubic drainage device for that purpose (159).

P.1442

The use of these types of devices is a matter of personal comfort and choice.

Technique of Endoscopic Resection

The anesthetized patient should be secured comfortably in the dorsolithotomy position. A routine abdominal examination of the anesthetized patient may disclose unexpected pathology and serves as a baseline for any subsequent examination. Shaving the genitalia and perineum is unnecessary unless perineal urethrostomy is anticipated. Any one of a variety of standard bactericidal preparations, including hexachlorophene (pHisoHex), povidone-iodine (Betadine), or chlorhexidine applied to the lower abdomen, genitalia, and perineum is adequate. Use of the O'Conor-type rectal shield provides ready, sterile access to the rectum. The grounding pad should be placed so that it will not be dislodged. The irrigating fluid should be maintained at body temperature and positioned at the lowest level relative to the patient that will allow adequate visualization. With these maneuvers completed, the resection may commence.

No one way to perform endoscopic removal of obstructing adenomatous tissue is applicable to all cases. Each urologist will develop an approach and modify it on a case-by-case basis. Despite the multiplicity of potential modifications, some generalizations are proposed.

Before the resection is initiated, the prostatic fossa should be carefully reexamined. The bladder neck, trigone, and ureteral orifices proximally and the verumontanum and external sphincter mechanisms distally should be noted and their relationship to the prostatic adenoma reaffirmed. A nontoxic isotonic or slightly hypotonic solution with satisfactory visual capabilities such as glycine (1.5%) or sorbitol should be used for irrigation.

Prominent obstructive middle lobe or bladder neck tissue that constitutes an impediment to movement of the resectoscope or the flow of chips into the bladder should be dealt with during the earliest phases of the resection. Currents with various characteristics may be desirable during different phases of these procedures. Mixed currents provide greater hemostasis but cut less freely. Undamped currents cut rapidly with little resistance or hemostasis. The urologist should monitor current settings closely during the procedure. Any organized, systematic approach to the resection of the intraurethral adenoma can be used effectively. Some prefer to resect the floor of the prostatic urethra initially. Others use a modification of the Nesbit (259) “encirclement” approach, whereby the anterior and lateral lobe tissue is allowed to “drop” onto the floor of the prostatic fossa for easy resection (135,359). This usually entails initiating the resection at the level of the bladder neck in two sweeping arcs, the 11 to 9 o'clock and 1 to 3 o'clock positions. Bladder neck fibers are exposed but not resected, carrying the longitudinal sweep of the resection just proximal to the base of the verumontanum.

During the initial stages of the resection, the tissue cuts smoothly with minimal effort. The chips thus produced should be boatlike in shape and equivalent in length to the extended loop. A synchronized rocking movement of the resectoscope sheath allows clean cutting of the chips. One should avoid cutting “mini-chips” because this produces an irregular prosthetic bed, which can hide bleeders and reduce operative efficiency . As the resection progresses, more deliberate movements are necessary to engage tissue by exerting a downward pressure on the sheath to facilitate the fulcrum effect. Digital elevation and manipulation of the prostate via the O'Conor shield can be a significant aid at this time. For added protection, the bladder should be partially filled while resection is performed in the area of the bladder neck.

Aggressive resection at the bladder neck, the 12 o'clock position anteriorly, and near the prostatic apex is best postponed until the end stage of the resection. The anterior aspect of the prostatic fossa is thin and easily perforated; it contains the most fragile portion of the external sphincter fibers. Risking overresection in any limited area before the major portion of the adenoma is removed may expose large venous sinuses and compromise the resection. The prostatic apex is best removed at the end of the procedure in a bloodless field with a finger in the rectum.

Hemostasis should be maintained throughout the procedure. Observations of the character and amount of blood in the irrigating fluid as it drains from the bladder will provide valuable feedback of the type and severity of bleeding. Arterial bleeding is identified not only by its bright color but also by its persistence during filling and drainage. Venous bleeding is not only dark but also decreases markedly or disappears with irrigation and increases with drainage. Arterial bleeding should be controlled by precise fulguration. This is facilitated by advancing the resectoscope close to the bleeder to attempt to visualize the vessel “in profile.” The possibility of “ricochet” bleeding with the actual site on the opposite wall or of a cryptic bleeding site that requires further resection to expose it should be kept in mind (136). Identifying bleeding at the bladder neck area can be facilitated by inspection with a nearly empty bladder (Fig. 32.31). Prompt recognition of the presence of transected

P.1443

venous sinuses is essential and can be facilitated by watching the drainage from the resectoscope. Partially occluding the inflow tubing intermittently may help locate arterial bleeders and identify venous bleeding. Identifying venous sinuses may be difficult; controlling them by fulguration almost always is difficult. The presence of a large open venous channel is an indication to lower the irrigating fluid as low as possible and to complete the operation with dispatch. Persistent inspection in the face of bleeding that is primarily venous can lead to significant fluid absorption and water intoxication. If the patient has signs of significant fluid absorption or the tissue remaining is appreciable, a catheter should be inserted to control venous bleeding quickly by tamponade and the procedure terminated.

FIGURE 32.31. Arterial bleeding from the bladder neck is best appreciated with a moderately empty

bladder, which permits projection of the bleeding site toward the operating surgeon. (From Greene LF. Transurethral prostatic resection: technique. In: Greene LF, Segura JW, eds. *Transurethral surgery.* Philadelphia: Saunders, 1979, with permission.)

The endpoint of the operation should be a cleanly excavated prostatic fossa exposing bladder neck and capsular fibers while leaving intact the trigone and ureteral orifices, the verumontanum, and the external sphincter mechanism. A very limited amount of residual tissue may be left abutting the external sphincter. It is far preferable to repeat the resection than to render the patient incontinent. Residual anterior and anterolateral tissue has been the most common problem we have noted in patients requiring repeat resection within a short time. This technically challenging area should be inspected carefully to make certain it is adequately but not overly resected.

Before the operative procedure is concluded, all tissue must be evacuated from the bladder with a Toomey syringe or similar device. The bladder, particularly diverticula, should be carefully inspected for residual tissue fragments. Reexamination of the prostatic fossa to secure final and adequate hemostasis is then best performed in the normotensive patient. If a venous sinus has been entered, persistent endoscopic searching and fulguration is ineffectual and can aggravate fluid absorption. Placing a Foley catheter with a distended balloon on moderate traction will usually result in prompt cessation of the bleeding. Despite considerable discussion regarding the advisability of using Foley catheter traction, no deleterious effect of this procedure has been documented. Although we share the practice of many in attempting to place and keep the balloon at the bladder neck, the studies carried out by Greene (135) would suggest that a distended balloon at least intrudes significantly into the prostatic fossa. Our practice is to maintain traction at least until the patient is back in his own room and then to release it as indicated by the degree of residual hematuria.

Closed-drainage systems reduce the risk of bacilluria in the postoperative period. The necessity to evacuate clots and maintain free drainage has resulted in the use of a number of different closed irrigating systems. Use of a three-way catheter with continuous inflow and outflow is effective if it is monitored by a skilled nursing group. If obstruction to the outflow tract is not recognized promptly, overdistention of the bladder can increase the problem with bleeding with this system. Intermittent irrigation from a reservoir is also commonly used and is our preference. A Y-tube connector that permits instillation of irrigating fluid into the bladder without breaking the closed system is affixed to the catheter. If it is necessary to break the closed system to irrigate the bladder manually, this should be done with concern for an aseptic technique.

Transurethral Incision of the Prostate

Evidence supporting a dynamic role for the peripheral condensation of stroma that acts as a prostatic capsule in the etiology of BPH-associated dysfunctional voiding has gradually accumulated (164,272). The partial resolution of symptoms noted in the patient with BPH treated with α-adrenergic blocking agents and the results achieved by open excision of the anterior prostatic commissure (326) suggest that capsular contraction or hypertonicity probably is a factor in the pathophysiologic changes resulting in BPH voiding dysfunction in some patients. Clearly, capsular contraction or constriction could augment the degree of luminal obstruction from adenomatous hyperplasia of the prostate.

Transurethral incision of the prostate (TUIP) is an operative approach attempting to disrupt the prostatic capsule to overcome these effects. Most reports of this procedure restrict its use to glands with estimated weights in the range of 30 g or less. A single or bilateral incision is usually made through the bladder neck to verumontanum. A cold or hot knife or resectoscope loop may be used. Incisions located posterolaterally (8 and 4 o'clock) are preferred. Loop excision aids visualization of the prostatic floor (239). Orandi (275) avoids bladder neck and complete capsular incision in young men to reduce risk of retrograde ejaculation. Li and Ng (207) advocate routine exposure of extracapsular fat with a resection from the trigone to the verumontanum. Most often the incision through the bladder neck should cause it to spring open (297). Bleeding and extravasation are associated with capsular division; Li and Ng (207) caution that bleeding should be controlled as soon as it is identified. Biopsies obtained with the resectoscope loop or a biopsy needle are generally desirable (207). Catheter drainage is used routinely in the postoperative period. Although bleeding may be severe and require transfusion, this is uncommon. The BPH panel literature review (230) indicated improved or satisfactory flow rates (7.5 mL per second preoperative to 15.1 mL per second postoperative), reduced residual urine (94%), and satisfactory improvement in subjective symptoms (80%) in patients selected for one of the approaches to TUIP. The reported incidence of retrograde ejaculation varied from 0% to 37%. Stress incontinence was experienced in 1.1% and total incontinence in 0.1% postoperatively. The re-treatment rate was 4% (239). TUIP warrants consideration as an alternative procedure to manage bladder neck obstruction in selected patients, particularly young men with limited prostatic hyperplasia and those wishing to preserve antegrade ejaculation.

P.1444

Postoperative Management

The postoperative course for most patients undergoing transurethral resection of the prostate is remarkably uneventful (132,239). The estimated fluid absorption of 800 to 1,000 mL in an uncomplicated resection should be kept in mind when ordering postoperative fluids (270). The patient is generally able to tolerate a liquid diet on the day of surgery. The development of bladder spasms should raise a question regarding unobstructed catheter drainage. Bladder spasms occurring without identifiable cause are often difficult to control with the catheter in place despite the use of a variety of anticholinergic agents, including belladonna and opium suppositories, oxybutynin (Ditropan), tolterodine (Detrol), and propantheline (Pro-Banthine). Because straining to eliminate hard, impacted stool may precipitate bleeding, administration of a stool softener is worthwhile. In the absence of documented capsular perforation or significant bleeding, the Foley catheter can generally be removed within 24 to 48 hours. Instillation of sterile saline into the bladder just before catheter removal provides a convenient opportunity to assess the adequacy of the urinary stream and may aid in the passage of small clots and tissue debris. A three-glass voiding cycle should be initiated to assess the volume and color of subsequent micturition.

Experiences indicating that day-of-surgery discharge is feasible in patients at average risk with uncomplicated procedures are being reported (389). We usually advise avoiding aspirin and antiinflammatory agents affecting platelet function and blood coagulation until the risk of significant secondary bleeding is minimal (2 to 3 weeks). The patient should be instructed to avoid straining and vigorous physical and sexual activity for several weeks. Epithelization of the excavated prostatic fossa is accomplished by migration and proliferation of transitional cells from resection margins and usually requires 6 to 12 weeks. Consequently, the patient should be informed of the possibility of mild delayed bleeding, often associated with the passage of sloughed tissue or eschar. Increased fluid consumption and realistic restriction of activity are usually successful in abating such symptoms.

Complications

Aside from the potential medical and surgical complications after anesthesia and surgery in general, several problems unique to endoscopic surgery require review. The intraoperative difficulties that must be recognized and discussed include the following: persistent penile erection; obturator spasm; hemorrhage; undermining of the bladder neck and trigone; perforation of the prostatovesical junction, capsule, or bladder; damage to the external sphincter; fragmentation of a prostatic lobe; and burn injury (136).

Persistent penile erection may develop at any point during general or regional anesthesia and may drastically limit endoscopic accessibility of the prostate and bladder. Detumescence often occurs without specific changes in management. Although detumescence may be associated with use of various nonspecific interventions, intracorporal lavage with pharmacologic agents such as phenylephrine (200 μγ per injection) (214) or dilute epinephrine (1:100,000) is currently the procedure of choice. If all of these maneuvers fail, temporary discontinuance of the procedure or use of a perineal urethrostomy should be done (Fig. 32.30).

The obturator reflex is most often triggered during a resection of bladder neoplasms located along the lateral wall but can be initiated during resection of a laterally situated intravesical adenoma. If this reflex is vigorous, exaggerated movement of the ipsilateral leg and pelvis can result in perforation. Use of high-intensity cutting current in a distended bladder predisposes to this event. Although downward adjustment of the current strength and partial evacuation of the bladder may obviate further problems, the risk of recurrent spasm usually requires a more aggressive approach. Use of a muscle relaxant, or alternatively, blocking of the obturator nerve as it traverses Alcock's canal by injection of a local anesthetic agent, usually solves the problem.

The usual techniques for controlling bleeding during transurethral resection are described in the previous section. Persistent significant bleeding as the procedure approaches its termination is usually due to the surgeon's failure to control arterial and venous bleeding during the course of the resection. However, the possibility of a coagulopathy also warrants consideration and selective evaluation, particularly if clotting is absent or poor. As indicated previously, if venous bleeding is suspected, balloon catheter tamponade will usually quickly control the bleeding and demonstrate the validity of this suspicion. If the bleeding is arterial, a systematic inspection of the prostatic fossa with variable, controlled, irrigating fluid inflow should lead to its identification and control. Extra care should be taken to inspect the anterior aspect of the bladder neck with the bladder empty and partially full to identify occult arterial bleeding in that troublesome spot. Balloon tamponade can also be used to control significant arterial bleeding, although direct surgical control is preferable. Every effort should be made to achieve satisfactory hemostasis at the time the patient leaves the operating room. If the bleeding persists despite these efforts and no underlying coagulopathy is identified, an open surgical approach may be necessary to control it either before termination of the resection or in the immediate postoperative period. As indicated, bleeding of sufficient severity to require transfusions occurs infrequently during the resection and in the postoperative period (240). If hypotension and shock develop, hypovolemia usually warrants primary consideration in patients with significant blood loss. However, other potential causes such as sepsis-, cardiac-, and drug-related etiologies should

not be dismissed without consideration, especially in patients with limited blood loss. The neodynium:yttrium-aluminum-garnett (Nd:YAG) laser with the right-angle noncontact fiber has been used successfully to control prostatic bleeding (193).

Frank perforation may occur at the level of the prostatovesical junction, the prostatic capsule, or the bladder itself. In addition to actual electroresection, the trauma from the beak of the instrument or overdistention of a thin prostatic capsule or bladder may be a factor in perforation. Overresection of the bladder neck and trigone may not only lead to perforation but also has been postulated to cause postoperative bladder neck contracture (136). Varying degrees of perforation are more common at the posterior aspect of the bladder neck, but anterior or lateral perforation of the prostatovesical junction is usually associated with substantially greater volume of extravasation. Extravasation associated with prostatic resection is almost always extraperitoneal. Visual evidence of perforation may vary from a cavernous opening with identifiable periprostatic or perivesical tissue to a subtle elongation of the prostatic urethra with eventual elevation and lateral impression of the bladder. The prostatovesical junction may become more distant and distorted. Extraperitoneal perforations in the bladder neck area do not generally produce sufficient abnormality in the irrigation pattern to allow their recognition. If unrecognized, signs of diminished bladder capacity and, in patients under regional anesthesia, peritoneal irritation (including abdominal pain, guarding, and tenderness) and nausea and vomiting may develop. Recognition of a perforation requires an assessment of existing and potential extravasation to guide subsequent management. A cystogram with a drainage film provides useful information. Limited extravasation can usually be handled with catheter drainage and observation. More extensive extravasation in a symptomatic patient usually requires perivesical drainage. The morbidity associated with prevesical space drains placed through a limited low-midline incision is not sufficiently great to warrant extensive measures to avoid it.

Intraperitoneal extravasation usually results from advancing or reinserting the resectoscope sheath vigorously and injuring the bladder dome. This can usually be avoided if the bladder is kept moderately filled. The probability of intraperitoneal extravasation is often signaled by a bizarre irrigation pattern where inflow greatly exceeds outflow and by peritoneal irritative symptoms, including unilateral or bilateral subdiaphragmatic pain. Endoscopic visualization of the bladder defect may be difficult and unnecessary. A cystogram should be performed to document the suspected abnormality. Modest degrees of intraperitoneal perforation can probably be handled with catheter drainage. Massive extravasation in a patient with profound symptoms usually requires lower abdominal transperitoneal exploration with appropriate drainage and possibly closure of the perforation (299).

Under normal circumstances, the internal sphincter constitutes the predominant continence mechanism in men. During the course of an adequate transurethral resection of the prostate, this sphincter mechanism is removed or rendered incompetent (305). The integrity of the external sphincter mechanism must be preserved, or total or stress urinary incontinence will ensue. Injury to the external sphincter mechanism can occur by actual cutting of its muscle fibers, aggressive and injudicious fulguration about the verumontanum and prostatic apex, and mechanical trauma induced by the beak of the resectoscope during the course of the resection of apical tissue. Needless to say, the verumontanum is an invaluable landmark that should be preserved. In general, resections that are terminated proximal or adjacent to the verumontanum are unlikely to be associated with significant injury to the external sphincter. As stated previously, the recognizable sphincter is represented by the area of the urethra that assumes a nearly circular shape and a corrugated appearance as the sheath is advanced into the membranous urethra and approaches the verumontanum area. However, the extent of the complex of smooth and striated muscle that makes up the external sphincter is not clearly demarcated, particularly as the fibers interdigitate and splay out proximally. The anterior muscle in this cone-tube configuration is the least substantial. These considerations should lead to caution in selecting not only the extent of the resection but also the depth distally. This is particularly true anteriorly (see Chapter 26A). When one considers the extent of sphincter resection necessary to affect sphincter function in purposeful external sphincterotomy, the fact that the mechanism of post–transurethral resection sphincter dysfunction is poorly understood becomes clear. Nevertheless, experience has indicated the need for caution in avoiding overresection in the distalmost portion of the prostate.

Resection of a portion of the prostate too large to be evacuated through the resectoscope sheath is an unusual complication that has been described during resection of a prominent intravesical middle lobe. This is avoidable if resection of the pedicle of the adenoma is done last. On completion of the resection, the surgeon can grasp the fragment with the loop or grasping forceps and draw it into the resectoscope beak; the entrapped fragment can then be removed as a single unit. Alternatively, it can be morcellated within the bladder or the prostatic fossa. Delayed retrieval of the fragment poses the danger of catheter occlusion in the immediate perioperative period.

The advent of solid-state electrosurgical units possessing isolated circuitry has made burn injury to patients and surgeons a rare event. Nevertheless, the possibility of inadequate grounding should be considered in the event of a less-than-optimal function of the working element during the resection. As more electronic and metallic devices are implanted in patients, the position of the ground and active electrode may require increased consideration to prevent

P.1446

interference with the function of these units (11). One other complication can occur as a result of interaction of the electric current with the irrigating fluid, namely, the possibility of an intravesical explosion caused by liberated gases. This potentially volatile interaction of electrical current, hydrogen, and air should be recognized by the urologist.

A variety of perioperative and postoperative complications have been associated with transurethral resection of the prostate. These include hemorrhage, the transurethral resection syndrome, catheter malfunction, development of urethral stricture and bladder neck contracture, urinary tract infection, shock, development of DVT and pulmonary embolus, and disorders of the cardiovascular, gastrointestinal, and central nervous systems.

Significant bleeding in the perioperative period is most often due to faulty intraoperative hemostasis, which has been discussed at length. Some delayed postoperative bleeding, usually caused by sloughing ischemic tissue or, less frequently, clot lysis is a relatively common event. Its incidence decreases as the postoperative period lengthens. In our experience, significant bleeding is far more common in patients who have had intraoperative venous sinus bleeding. It is rare after 21 days. Usually, a significant secondary bleed is controlled by insertion of a catheter, evacuation of clots, and tamponade. Reoperation is occasionally required to achieve complete clot evacuation and to fulgurate the arterial bleeders. Limited bleeding may occur for several weeks after the initial resection, is usually transient in nature, and customarily responds promptly to curtailing physical activity and initiating liberal fluid intake. In patients with prolonged or recurrent bleeding, the possibility of a variety of important contributing hematologic disorders such as disseminated intravascular coagulation, primary fibrinolysis, decreased factor VIII, and von Willebrand's factor warrant consideration.

Many of our current conceptions regarding the etiology of the transurethral resection syndrome stem from the observations of Hagstrom (144) and Harrison and associates (151). The pressure within the prostatic venous system is approximately 10 mm Hg. Uncomplicated resections will ultimately expose multiple small venous sinuses as the resection approaches the capsule. Excessive absorption of irrigating solution can occur if the solution is administered under a pressure that exceeds normal venous pressure, particularly during the course of a lengthy resection (greater than 1 hour). Consequently, most urologic surgeons currently use a nonisotonic irrigating solution such as 1.5% glycine with an osmolality of about 200 mOsm/L compared with the serum osmolality of 290 mOsm/L. Excessive systemic absorption of this solution will result in a dilutional hyponatremia, hypoproteinemia, and ultimately a decreased serum osmotic pressure. Such events promote fluid shifts that are ultimately responsible for cerebral or pulmonary edema. As cerebral edema becomes more pronounced, the intracranial pressure rises and produces the characteristic clinical signs of the so-called transurethral resection syndrome: bradycardia, hypertension, tachypnea, confusion, agitation, muscular twitching, nausea, vomiting, and headache. This chain of events may progress to frank convulsions and coma, particularly if the serum sodium level plummets to less than 120 mEq/L (157). This syndrome was diagnosed in 2% of the 3,885 patients subjected to transurethral resection from 13 institutions reviewed retrospectively by Mebust and associates (240). Transurethral resection syndrome was not listed as a cause of any of the nine deaths in this series. As discussed previously, prompt recognition of increased risk of irrigating fluid absorption is the hallmark of prevention and treatment. The irrigating solution container should be lowered to the minimum level necessary to facilitate visualization. The procedure should be terminated after securing hemostasis and evacuating tissue fragments. Peripheral IV lines should be adjusted to a keep-open rate. Serum electrolyte levels should be obtained promptly to confirm the diagnosis. Our current practice is to obtain a prompt postoperative serum sodium in any patient with a recognized risk factor for increased irrigating fluid absorption, making failure to recognize mild forms of this syndrome unlikely. A serum sodium level less than 120 mEq/L indicates a significant dilutional effect. Intravenous furosemide (Lasix) should be administered. Because the diuretic response of the elderly patient is unpredictable, it seems best to start with a relatively small dose, about 5 to 10 mg IV, and adjust the dosage accordingly. Transient visual disturbances or blindness during the initial stages of this syndrome signify significant CNS toxicity. Although rare, these problems can be distressful to both the urologist and family. Full reversibility is generally reported. In the presence of profound CNS symptoms, the administration of hypertonic saline should be done; the amount required to restore serum sodium levels and osmolality can be calculated. In general, the administration of about 200 mL of 3% sodium chloride solution during a 3- to 6-hour period will produce a dramatic improvement in clinical signs and symptoms. Although concern regarding judicious rapid correction of severe hyponatremia with hypertonic saline to achieve a mild hyponatremic state is probably not warranted from the standpoint of development of a demyelinating lesion of the brain (central pontine myelinolysis), rapid conversion of hyponatremia to normonatremia or hypernatremia, an increase of more than 25 nmol/L with initial therapy, or both, may be a factor in the development of these lesions. This risk is accelerated by the presence of a hypoxic-anoxic episode, alcoholism, or hepatic coma (14). The patient's hourly urine output and fluid intake should be recorded. In the presence of severe cerebral and pulmonary symptoms, invasive cardiopulmonary monitoring in an intensive care setting is advised.

The cause of the transurethral resection syndrome may be potentially more complex than previously suspected (157,315). Immediate or delayed encephalopathic symptoms associated with markedly elevated serum ammonia levels have been reported after TURP with glycine as the

P.1447

irrigating fluid. With excessive absorption of glycine, several metabolic pathways that involve deamination and liberate free ammonia are activated in addition to the major one involving interconversion of glycine with serine. James and associates (169) have hypothesized that cerebral astrocytes detoxify ammonia by the production of glutamine from glutamic acid. The accumulation of glutamine and its conversion to serotonin, accompanied by a decrease in dopamine and norepinephrine, may be important etiologic factors in the neurologic symptoms of patients with hyperammonemia (157). Patients at high risk include those with documented hepatic disease, marked skeletal muscle atrophy, urinary tract infection and bladder stones, and obstructive uropathy. Treatment is generally supportive, with the realization that the encephalopathy may be somewhat prolonged, lasting up to 36 hours. If seizure activity develops, anticonvulsant medication may be required.

The indwelling Foley catheter can contribute directly to immediate and delayed complications by failing to deflate and indirectly by facilitating urethritis and probably stricture formation. A variety of maneuvers have been used to deflate the inflated retention balloon. These include simple compression of the filling stem, overdistention with additional fluid, injection of mineral oil, and puncturing the balloon with a wire stylet inserted through the access channel or with a fine spinal needle introduced suprapubically. Success has also been reported with procedures using a ureteroscope passed along the catheter or a cystoscope introduced to puncture the balloon after the divided catheter secured by a dangle suture has been pushed into the bladder (24).

The role of the catheter in urethral stricture formation is supported by the decrease in this complication after suprapubic as compared with urethral catheter drainage (149). The potential etiologic role of urethritis is supported by the decreased stricture incidence associated with prolonged antimicrobial therapy after transurethral resection. The urethral meatus should be cleaned of mucus and crusts regularly; the catheter surface should be kept free of foreign substances. The rare development of a severe generalized urethritis with fever warrants an attempt to identify the organism and to institute antibiotic therapy promptly. The catheter should be removed as soon as possible. If an inflammatory reaction such as a meatitis is recognized, gentle, frequent dilation of the inflamed site will usually prevent development of a stricture. In the case of a severe meatitis, our practice is to provide the patient with a dilator and teach self-dilation. If the constricting urethritis is in the more proximal urethra, frequent, atraumatic dilation by the urologist in the postoperative period will also often prevent development of a significant stricture. Concern for the prevention of strictures does not stop with removal of the catheter.

With regard to the related topic of bladder neck contracture, the estimate that as many as 2% of the patients undergoing transurethral electroresection of the prostate have this complication seems high in our experience (136). As indicated in the section on technique, contracture is thought to result from overresection and injudicious fulguration about the bladder neck. Undermining of the bladder neck and trigone may create a free flap that heals as a membrane. Early recognition of the risk of a contracture is facilitated by careful attention to the patient's description and observation of his urinary stream or by routine flow studies. An unusual degree of pain in the postoperative period should also raise suspicion of an inflammatory reaction in the area of the bladder neck. Prompt outpatient endoscopic evaluation is informative and easily accomplished (Fig. 32.32). If a significant constricting inflammatory reaction is identified in this region, gentle calibration and dilation are worthwhile. Contractures usually become manifest with obstructive symptoms from 3 weeks to 10 years after resection, with an average interval of approximately 6 months (136). If gentle dilation does not suffice, reevaluation with endoscopy is advised. If the bladder neck orifice cannot be located endoscopically, IV administration of methylene blue, induction of a diuresis, and use of suprapubic pressure may produce an identifying jet of blue urine. A ureteral catheter passed into the bladder can guide the incision of the constricting ring with an optical urethrotome, Collins knife, or resectoscope loop until it springs open. Once complete division of the constricting tissue band is achieved, more extensive resection of the scarred tissue is probably best avoided. Again, frequent, gentle postoperative calibration and dilation will help prevent recurrence. In recurrent contractures, a Y-V–plasty of the

P.1448

bladder neck will usually solve the problem and should be considered.

FIGURE 32.32. Typical appearance of bladder neck contracture. The opening to most diaphragmatic contractures can be found in the anterior position near 12 o'clock. (From Greene LF, Holcomb GR. Transurethral resection in special situations. In: Greene LF, Segura JW, eds. *Transurethral surgery*. Philadelphia: Saunders, 1979, with permission.)

Open Prostatectomy

Suprapubic Prostatectomy

As the instrumentation and skills for endoscopic resection of the prostate have improved, the indications for open prostatectomy in the practice of most urologists have diminished. Factors influencing the choice of the suprapubic approach for enucleation of obstructing adenomatous tissue include the presence of a prominent, intravesical component; associated bladder pathology, such as a large, narrow-necked vesical diverticulum or multiple large bladder stones; and the need for an open prostatectomy in an obese patient in whom the retropubic approach is technically more cumbersome (69). Suprapubic prostatectomy is a relatively simple procedure that nevertheless requires meticulous attention to surgical detail (256,267).

After the induction of satisfactory general or regional anesthesia, the operating table should be gently flexed in the modified Trendelenburg position to facilitate exposure of the male pelvis and retraction of the peritoneal reflection. Exposure of the bladder is enhanced if the latter is filled to approximately 150 to 200 mL. Use of a fiberoptic headlight may aid visualization of the prostatic fossa after enucleation.

A transverse (Pfannenstiel) or lower midline incision may be used depending on the procedure planned, the patient's build, and the presence of previous surgical scars. In the preferred Pfannenstiel incision, extending the incision too far laterally should be avoided to decrease the risk of postoperative hernia. Awareness of potential injury to the underlying inferior epigastric vessels is important with either incision. Incision and separation of the thin fascial envelope constituting the umbilicoprevesical fascia and partial separation of the peritoneal reflection from the dome of the bladder facilitate exposure of the partially distended bladder. After stay sutures are placed in the bladder wall, a transverse incision 1.5 to 2.0 cm above the bladder neck provides exposure of the prostatic fossa with minimal risk of disrupting the bladder neck and the prostatic capsule. Incising the detrusor muscle with electrocautery or scalpel exposes the mucosa. After this is incised and the edges of the incision are secured with Alice clamps, it is enlarged by careful lateral digital traction. After evacuating the bladder contents, a single moistened lap pad inserted into the bladder dome provide *s* a buttress for a retractor. Further exposure of the bladder neck can be achieved by placing a Deaver along the lateral vesical wall. Careful examination of the bladder, especially to locate the trigone and the ureteral orifices and identify associated bladder pathology, is important before enucleating the obstructing adenoma. Circumferentially scoring the mucosa bordering the bladder neck with electrocautery prevents excessive tearing during enucleation of the prostate (Fig. 32.33). The enucleation should be initiated by inserting the index finger into the prostatic fossa and cracking the anterior commissure with anterolateral pressure against the larger adenoma. Blunt enucleation should be carried out in the cleavage plane between the surgical capsule and the adenoma with pressure primarily directed against the adenoma (Fig. 32.34).

FIGURE 32.33. Circumferential bladder neck incision before transvesical enucleation of prostatic adenoma. The bladder neck is most easily exposed by the placement of small Deaver and malleable retractors laterally and a medium Deaver superiorly. The trigone and ureteral orifices should have been exposed and kept from harm's way. The incision through the mucosa overlying the bladder neck is best established with electrosurgical instruments. (From O'Conor VJ Jr. Suprapubic and retropubic prostatectomy. In: Harrison JH, et al, eds. *Campbell's urology,* vol 3, ed 4. Philadelphia: Saunders, 1979, with permission.)

FIGURE 32.34. Finger enucleation of the prostatic adenoma is best accomplished by “cracking” anterior commissural tissue and then establishing the plane between the adenoma and the surgical capsule on both lateral aspects. Although esthetically pleasing, intact removal of very large glands may be ill-advised. In that case, the use of lobe forceps may facilitate the sequential removal of lateral and middle lobe tissue. (From O'Conor VJ Jr. Suprapubic and retropubic prostatectomy. In: Harrison JH, et al, eds. *Campbell's urology,* vol 3, ed 4. Philadelphia: Saunders, 1979, with permission.)

P.1449

The apex of the adenoma should be separated from the area adjacent to the external sphincter bilaterally; both lateral lobes should be free. The urethra should be divided sharply or bluntly by “pinching” just proximal to the distal apical adenoma. Traction on the distal urethra should be avoided while the capsule is teased from the apex of the adenoma to minimize sphincter injury. Finally, the adenoma should be separated with care from the bladder neck, especially posteriorly in the area of the ureteral orifices. Enucleation may be facilitated by placing the fingers of the free hand or an assistant's hand in the rectum to push the prostate ventrally in a cephalad direction. The sequence of the enucleation should be varied depending on the configuration of the adenoma and the ease of enucleation. At times, the median or subtrigonal lobe should be attacked initially. In a large gland with multiple adenomas, sequential removal is preferable to traumatic removal of the adenomatous growth in toto.

Unusual adherence of the adenoma to the capsule should increase suspicion of carcinoma. Once the adenoma is removed, rapid control of bleeding becomes the major concern. Often, a portion of the blood supply is identifiable as the adenoma is being removed and can be clamped and ligated. Unless bleeding is massive, rapid inspection of the prostatic fossa with supplemental lighting, a narrow Deaver, and partially open ring forceps to aid in the exposure is usually advisable at this time. Irregular tissue tags or fragments can be sharply removed; sizable bleeders can be controlled by suture ligature or by fulguration. Introduction of a gauze pack into the prostatic fossa with blunt-tipped forceps, a standard hemostatic procedure in the past, is now used selectively. It is an excellent maneuver to achieve rapid control of significant bleeding. Placement of side-on (Halsted) hemostatic mattress sutures of absorbable suture incorporating bladder mucosa, bladder neck, and prostatic capsule at 5 and 7 o'clock (Fig. 32.35) is facilitated by use of the so-called genitourinary (five-eighths) curved needle. The needle-bearing end of the tied suture can be used later to anchor the bladder neck to the prostatic fossa. The fossa should be inspected again by retraction as before, and significant bleeding should be controlled with suture ligatures or fulguration. Persistent bleeding from deep in the posterior aspect of the prostatic fossa can be controlled at times by three transverse plication sutures of 0 chromic catgut placed in the prostatic fossa as described by O'Conor (268) (Fig. 32.36). Before trigonalization of the prostatic fossa, a V-shaped wedge can be removed from the 6 o'clock area of the bladder neck if it is extremely tight (Fig. 32.37). Anchoring the bladder neck to the posterior aspect of the prostatic fossa facilitates hemostasis and prevents the formation of an obstructing membrane (Fig. 32.38). This maneuver also aids any subsequent catheter placement. At this point, a 22- or 24-Fr Foley catheter with a 30-mL balloon is directed into the bladder, the balloon is distended appropriately for the size of the bladder neck, and traction is applied.

FIGURE 32.35. Placement of hemostatic sutures at the bladder neck. Although the urethral branches of the prostatovesicular artery traditionally enter at the 5 and 7 o'clock positions, this is highly variable. Placement of 0 or 2-0 hemostatic chromic sutures at the bladder neck or within the prostatic fossa is greatly facilitated by the use of $^5/_8$ curved genitourinary needles and fiberoptic lighting. (From O'Conor VJ Jr. Suprapubic and retropubic prostatectomy. In: Harrison JH, et al, eds. *Campbell's urology,* vol 3, ed 4. Philadelphia: Saunders, 1979, with permission.)

FIGURE 32.36. Placement of hemostatic plication sutures. Uncontrolled bleeding from the depths of the prostatic fossa can often be contained by the placement of several 0 chromic plication sutures into the posterior aspect of the prostatic fossa, creating an accordion-like effect. (From O'Conor VJ Jr. Aid for hemostasis in open prostatectomy: capsular application. *J Urol* 1982;127:448.)

FIGURE 32.37. Wedge resection of bladder neck. Following enucleative prostatectomy, the bladder neck is generally patulous, and routine wedge resection is not necessary. In fact, one can take advantage of the capacious bladder neck by using the previously placed hemostatic sutures to “retrigonalize” the posterior aspect of the prostatic fossa. Should the bladder neck appear unduly snug, a ventrally directed wedge resection can be performed following either suprapubic or retropubic approaches.

FIGURE 32.38. “Retrigonalization” of prostatic fossa. The previously placed and tied hemostatic mattress sutures at the bladder neck can be anchored to the posterior aspect of the surgical capsule to advance the bladder neck into the prostatic fossa. This maneuver aids hemostasis and facilitates appropriate healing.

Traditionally, problem bleeding has been approached by attempts at direct visualization and suture or cautery control, use of hemostatic agents such as microfibrillar collagen (Avitene) or oxidized cellulose (Surgicel) placed in the prostatic fossa with temporary gauze packing or wrapped around the balloon, or on rare occasions, by an occlusive, preferably removable, pull-out suture of the bladder neck (221). Use of modern endoscopic visualization and hemostatic procedures warrants consideration in these unusual circumstances. A large (28- to 36-Fr) Malecot or de Pezzer catheter placed through a separate stab wound in the bladder dome away from the peritoneal reflexion and the trigone functions as a drainage tube. After removal of all sponges, drains should be placed on each side of the bladder neck and brought through a stab wound just above and away from the symphysis. Bladder closure should be performed in two or three layers. The mucosa can be approximated with a running suture of 3-0 or 4-0 plain catgut, usually incorporating muscle as well. The superficial and deep muscle of the bladder can be reapproximated with interrupted Lembert sutures of 2-0 chromic catgut. The adequacy of closure and hemostasis can be assessed by through-and-through irrigation. The effluent should be pink to clear. The suprapubic tube should exit through a separate, superiorly placed stab wound. The appropriately placed drains and suprapubic tube should be secured at the skin level. Routine wound closure with absorbable sutures should include approximation of the rectus muscle. As the patient awakens from anesthesia, catheter irrigation should be repeated and traction maintained on the Foley catheter with adhesive strapping to the thighs. The urethral and suprapubic catheters are

P.1450

P.1451

attached to separate drainage systems and intermittent or continuous closed irrigation used as desired. The patient should be observed as his blood pressure normalizes postanesthesia to ensure that adequate hemostasis has been achieved and patency of the catheter is maintained. Ordinarily, the Foley catheter traction can be released within 12 hours and the catheter removed on the second or third postoperative day. The drains may be removed when clinically apparent drainage ceases or after removal of the suprapubic catheter. The latter has generally been discontinued on the sixth or seventh postoperative day. This schedule is commonly advanced currently. If voiding is not resumed and the suprapubic tube site closed by 48 to 72 hours, reinsertion of the urethral catheter may be necessary. Persistent suprapubic drainage usually requires endoscopic and, at times, cystographic assessment to evaluate the possible presence of persistent obstructing tissue or a foreign body. Other, more remote causes may warrant consideration if the fistula becomes chronic.

Retropubic Prostatectomy

Retropubic prostatectomy using a direct ventral capsulotomy is judged by many to permit a more exact adenomectomy and facilitate direct hemostasis (156). Since its refinement and popularization by Millin (243), this approach has been preferred by many, particularly for BPH associated with prominent intraurethral components.

Antibiotic prophylaxis probably has added importance in the retropubic approach because of the increased risk of osteitis pubis (387). The preoperative preparation and operative approach are identical to those described for suprapubic prostatectomy except for advisability of decompressing the bladder before dissection on or about the prostatic capsule. As the result of experience with radical retropubic prostatectomy, exposure and suture ligation of the dorsal vein on the anterior surface of the prostate to permit incision of the capsule has become a common experience. After placing proximal and distal tagged sutures, a transverse capsulotomy is generally made with electrocautery or a scalpel 1 cm distal to the bladder neck. The capsulotomy should be extended to the lateral borders of the anterior capsule without violating or undermining the inferior edge of the capsule. Establishing the plane between the surgical capsule and the underlying adenoma (Fig. 32.39) is facilitated by using gentle traction on the stay sutures and curved Mayo or Metzenbaum scissors for dissection.

FIGURE 32.39. Retropubic prostatectomy is best performed through a transverse capsulotomy incision. Once the latter is established, the plane between the true capsule and the adenoma is best established with sharp dissection followed by standard digital enucleation. (From Staffon RA. Retropubic prostatectomy. In: Glenn S, ed. *Urologic surgery,* ed 3. Philadelphia: Lippincott, 1983, with permission.)

Once the appropriate surgical plane has been entered, the enucleation of the obstructing adenoma is similar to that described for suprapubic prostatectomy. In general, larger glands are more easily enucleated with blunt-finger or closed scissor-tip dissection. Unexpectedly small glands may be more precisely dissected sharply with curved tissue scissors. The enucleation should usually begin in the apical aspect of the gland. The urethra is easily divided under direct vision at the apex of the adenoma without tension. Bleeding sites are visualized and fulgurated or secured with suture ligatures. The direct access to the prostatic fossa provided by the transcapsular incision facilitates the achievement of hemostasis. After bleeding has been controlled, a wedge resection of the bladder neck may be performed if indicated. Similarly, retrigonalization of the bladder neck to the prostatic fossa should be considered to facilitate hemostasis, accelerate reepithelization, prevent fibrosis, and aid future retrograde catheter manipulations.

A 22- or 24-Fr Foley catheter with a 30-mL balloon should be inserted into the bladder, the balloon inflated appropriately, and gentle traction applied. After the catheter has been inserted, the capsulotomy is closed, usually with interrupted mattress sutures of 2-0 chromic catgut. Closure of the wound proceeds in a fashion identical to that described previously. A suprapubic catheter is customarily avoided but can be inserted if necessary. Again, intermittent or continuous closed irrigation can be used. The urethral catheter is usually left indwelling for 4 to 7 days.

Complications of Open Prostatectomy

Recent reports of short- and long-term experiences with open prostatectomy are conspicuously lacking. Consequently, the improvements in morbidity and mortality rates in surgical procedures in general that have occurred in the last two decades are reflected minimally in the data available regarding these presumably technically mature procedures. The reports of open prostatectomy used for the BPH guideline studies summary (230) were published in 1987 or earlier. The mean perioperative mortality rate was 2.4% (90% CI 1.0%

to 4.6%). This compares with the progressively

P.1452

decreasing mortality rate at our institution: from 8.5% in 1942 to 1950, to 2.1% in 1961 to 1965, to 1.4% in 1965 to 1970, to 0% in 1971 to 1982 (257). The mean and median overall (any complication regardless of severity) complication rate cited in the guidelines is 21% (90% CI 7.0% to 42.7%). The 1.5% mean risk of perioperative intervention for bleeding and 35% risk of transfusion compares with 0.3% and 8%, respectively, by Nicoll and colleagues (261). In the latter series, more than half of the patients undergoing transfusion received 1 unit of blood, an unlikely occurrence today. The guidelines review indicated a mean incidence of epididymitis of 2.6% and of urinary tract infection of 13.4%.

Osteitis pubis is an uncommon postprostatectomy complication that can cause nagging to severe pain in the region of the symphysis, pelvis, or lower abdomen. Although most often associated with the retropubic approach, it can follow suprapubic and transurethral prostatectomy and even simple urethral instrumentation (107). Symptoms usually begin within 6 weeks of the operation. A low-grade fever, limited adduction of the thighs, and significant discomfort on bilateral medially directed pelvic pressure raises suspicion of the presence of osteitis pubis. Radiographic changes in the bone, although not always present, are usually recognizable 2 to 4 weeks after the onset of symptoms (385).

Complications usually but not always recognized with more prolonged follow-up include urethral stricture, with a mean incidence of 2.6%, and bladder neck contracture, with a mean incidence of 1.8% reported in the guideline review of open prostatectomy (230). Both are reported to occur more frequently with a suprapubic than a retropubic approach, but this may be more reflective of the period of data accumulation than the procedures. The mean incidence of new onset of postoperative erectile dysfunction (32% perineal, 16% retropubic, 18% suprapubic) is much lower than the risk of retrograde ejaculation (77%). The median risk of stress incontinence (retropubic, 1.5%; suprapubic, 2.6%) and total incontinence (retropubic, 0.5%; suprapubic, 0.3%) noted in the literature review seems likely to be relatively stable. Postoperative erectile dysfunction and incontinence are phenomena with multiple age-related causes that may be related temporally but not necessarily etiologically to the surgical procedure. The BPH guidelines report (230) cites an estimated re-treatment rate of 2% (CI 1% to 4%) within 1 to 5 years of performance of an open prostatectomy. No data are presented regarding the need for immediate intervention in patients who either are unable to void or have unimproved or worsened voiding dysfunction after surgical intervention. Patients who are unable to void, have persistent drainage from the suprapubic site, have unchanged or troublesome symptoms, or have chronic urinary tract infection require prompt evaluation, usually including consideration of endoscopic, voiding cystourethrographic, or urodynamic studies. Although less common than after TURP, failure to remove obstructive BPH tissue may occur with open procedures. Other factors, especially unsuspected neurogenic dysfunction, may be identified. In a Health Care Financing Administration–sponsored retrospective review of 2,617 Medicare patients undergoing a prostatectomy for BPH in 1985 (168 open, 2,449 TURP), the probability of reoperation in a 2-year time frame was 1.84% for patients undergoing open prostatectomy and 2.72% for those undergoing TURP (354). To our knowledge, no deleterious, long-term, systemic effects of open prostatectomy have been recognized or proposed on the basis of evidence.

Operative Results of Transurethral Resection of the Prostate and Open Prostatectomy

As recently as 25 years ago, a summary of mortality from BPH and its sequelae indicated surprisingly high rates in many countries. Admittedly, these data represent use of different criteria for assignment of cause of death and variable accuracies in reporting and accounting (310). Nevertheless, the development of adequate diagnostic and therapeutic approaches to BPH has been accepted by urologists and the medical community in general as an important advance in improving both survival and quality of life. Surprisingly, despite the fact that approximately 106,000 prostatectomies are performed yearly in the United States and that this procedure ranks high with regard to compensation by Medicare, reliable objective assessments of the effect of this procedure on prolongation of life and its quality are relatively sparse (153,160,389). During the past 50 years, the operative mortality rate associated with all of the commonly performed surgical procedures used to relieve bladder neck obstruction caused by BPH has declined (132) and continues to do so despite a continuing contraction of the pool of individuals who are denied consideration for these procedures because of the severity or multiplicity of comorbidities.

Recent reports in the United States indicate that the risk of mortality from open prostatectomy is much less than 1.0%, and the risk of death to patients undergoing transurethral prostatectomy is less than 0.01% (240,354,378). This low mortality rate seems remarkable, because a selective survey of patients undergoing transurethral resections in the United States in the 1980s showed that a distinct minority (less than 25%) had no significant concurrent medical problems. In this survey, patients older than 66 years of age had a somewhat increased risk of death (0.33% compared with 0.09%); those older than 80 years and those with resected adenomas weighing more than 45 g had an increase in postoperative complications (240). The published results of a multi-institutional retrospective evaluation of 3,885 patients undergoing transurethral resection indicated a postoperative death rate of 0.23% within a 30-day postoperative period or during the postoperative hospital stay, whichever

P.1453

was longer (240). The common causes of death were sepsis and myocardial infarction. More recent studies report an operative mortality rate of 0% (378). This progressive drop was achieved despite the fact that TURP patients are prone to multiple medical problems. Information from the Medicare claims data suggests that the TURP mortality rate is age dependent, ranging from 0.01% at age 65 to 6.2% at age 85 (20). Roos and Ramsey (306) reported that the mortality rate from prostatectomy is more than double that usually reported if the observations include the 90-day period after operation rather than simply the time from operation until hospital discharge. Roos and colleagues (307) reported that review of data from substantial centralized data banks in the United Kingdom, Denmark, and the province of Manitoba in Canada revealed an increased death rate within a 5-year period in patients subjected to transurethral resection as compared with those subjected to open prostatectomy. The excess risk seemed to be related to death caused by myocardial infarction. The role of patient selection in this outcome, a highly probable explanation in the view of most urologists, could not be confirmed with the data available to the authors.

Subsequent efforts attempting to compensate for comorbidity have yielded conflicting results. Malenka and colleagues (222) reported no evidence that comorbidity played a role in the 5-year mortality rate of patients subjected to TURP as compared with those subjected to open prostatectomy in a retrospective chart review of individuals operated at the Manitoba Health Center, Winnipeg, Canada, from 1974 to 1980. Open prostatectomy was the chosen procedure in about one-fourth of these patients. An evaluation based on record reviews of 1,617 Medicare patients operated in 1985 in seven geographically separated states failed to confirm an increased risk of death independent of comorbidity within the 2-year follow-up period in the 93% of patients undergoing TURP (354). In a related study of the incidence of acute myocardial infarction and cause - specific mortality after TURP and transurethral microwave thermotherapy (TUMT), investigators identified a higher number of myocardial infarctions than expected in the general population (145). The incidence of myocardial infarction following TUMT was slightly higher than after TURP. This phenomenon was judged to reflect an association of prostate enlargement and BPH voiding dysfunction with cardiovascular disease rather than being linked to either procedure. We agree with the BPH guidelines assessment (230) as well as others (327) and judge that the data supporting an independent role of TURP in delayed postoperative mortality is unconvincing at this time.

Prostatectomy by any route is a significant surgical undertaking that attempts to achieve a satisfactory functional and symptomatic status in a complex multifunctional system. Mebust and colleagues (240) cited an 18% incidence of complications in the immediate postoperative period after transurethral resection, including bleeding requiring transfusion, clot retention, and infection. Although Roos and Ramsey (306) reported that only 65% of the patients had no surgery-related problems within 2 years after prostatectomy, this figure seems likely to represent an overstatement of true complications because it includes, for example, patients who had a single urethral sounding postoperatively. Our estimate of the nonlethal, postsurgical complication rates after prostatectomy of 15% to 20% (132) compares to the mean incidence of surgical complications regardless of severity of 21% for open prostatectomy, 12% for TUIP, and 15% for TURP reported in the BPH guidelines (230). Not surprisingly, undesirable results occur because of inappropriate patient selection, unrecognized preexisting and imminent pathologic changes, and technical errors. Of the undesirable results, the inability to void and the development of incontinence are thought to be the most disturbing.

In the cooperative evaluation of transurethral resection, 6.5% of patients were unable to void when the catheter was removed, and 2.4% were sent home with an indwelling catheter; more than half of the latter had atonic bladders (240). Seaman and colleagues (324) documented impaired detrusor contractility in 25% of 129 symptomatic men undergoing delayed postprostatectomy urodynamic evaluation. This perplexing voiding dysfunction may result from chronic severe obstruction and may be at least partially reversible with long-term catheter drainage. We frequently use suprapubic catheter drainage in this group, often as a planned approach, to permit achievement of satisfactory symptomatic and objective voiding status.

Center studies report a low incidence of incontinence ranging from 0% to 1.4% for both open and endoscopic procedures (161,269). However, a prospective study of patients subjected to prostatectomy by urologists in the state of Maine reported that 4% had a problem with dripping or wet pants persisting for 1 year after operation (99). This study also reported a 15% incidence of one or more episodes of acute retention caused by blood clots within 3 months of surgery. The BPH guideline studies (230) indicate a median incidence of stress incontinence of 1.9% after open prostatectomy, 1.75% after TUIP, and 2.1% after TURP. The median incidence of total incontinence was 0.5%, 0.1%, and 1.0%, respectively.

With regard to sexual function, retrograde ejaculation is an anticipated phenomenon whose incidence has been reported to vary from 30% to 100% (42,242). A mean probability of retrograde ejaculation of 24.9% for TUIP, 73.4% for TURP, and 77.2% for open prostatectomy reported in the BPH clinical practice guidelines (230) supports the importance of surgical approach and technique in the occurrence of this phenomenon. In general, this postoperative sequela does not constitute a disabling problem for the elderly patient adequately prepared for its eventuality. In contrast to incidence of postoperative retrograde ejaculation, most men who are sexually active and have a willing sexual partner preoperatively maintain satisfactory erectile function after prostatic surgery. Finkle and

Prian (94) reported potency rates of 95%, 87%, and 71% after transurethral, suprapubic, and perineal prostatectomies, respectively. Fowler and associates (99) reported that 5% of the patients in their survey indicated a persistent inability to achieve erections after transurethral resection. TUIP is associated with a 12% and TURP a 14% incidence of postoperative erectile dysfunction.

Current data indicate that previous estimates of re-treatment rates after surgical therapy of BPH have probably represented an underestimate. Taylor and Krakauer (354) cited a 2.7% probability of repeat prostatectomy within 2 years of TURP and a 1.8% probability within 2 years of an open prostatectomy. Many, if not most, of these repeated procedures resulted from technical errors. Others may represent unrecognized diagnostic errors. Roos and Ramsey (306) assessed the reoperative rate to be 17% for transurethral resection, 5% for suprapubic procedures, and 7% for retropubic procedures in an 8-year data accumulation based on Manitoba claims information. Data from Denmark and the United Kingdom (307) indicated a 12% reoperation rate, and data from Wisconsin showed a 16% reoperation rate (263) after transurethral resection in 8- and 7-year operation periods, respectively. The open prostatectomy reoperation rates at 8 years were 5% for Denmark and 2% for the United Kingdom (307). The estimated reoperation rate at 5 years cited in the BPH guidelines is 2% for open prostatectomy, 9% for TUIP, and 10% for TURP. These re-treatment rates include treatment of complications of the surgical procedure and removal of residual or recurrent BPH.

The previously mentioned mortality and morbidity data should not detract from the fact that most, approximately 90%, of all men subjected to prostatectomy for the treatment of BPH demonstrably benefit from the procedure (286,334). A variety of approaches to assess the results achieved by prostatectomy have been advocated and used, including subjective evaluation by the patient and objective assessments based on symptom scores, urodynamic evaluation, or both. Each has its advantages and disadvantages. The varying indications for surgical intervention complicate the evaluation when rigid criteria are used, as does the knowledge that approximately 45% and 40% of patients treated with placebo or watchful waiting report overall symptomatic improvement (230). The percentage of patients who judge their voiding symptoms to be better or much better after surgery varies from 75% to 93%, in part depending on the severity of the patient's initial symptoms and the duration of the follow-up (41,99,203). The BPH guidelines (230) review indicates an overall symptomatic improvement of 98% (90% CI 94% to 99.8%) for open prostatectomy, 88% (90% CI 75% to 96%) for TURP, and 80% (90% CI 78% to 83%) for TUIP. The guidelines data review indicates that the surgical procedures produced about an 80% improvement in symptom scores, appreciably higher than the 30% to 40% range for placebo and nonsurgical therapies. A multicenter randomized trial conducted at VA hospitals compared transurethral surgery with watchful waiting in a group of men classified as having moderate symptoms (378). Transurethral resection was significantly more effective than watchful waiting in improving genitourinary symptoms and avoiding treatment failure. The men who were substantially bothered by urinary problems had a 91% (134 of 148) chance of improvement as compared with 62% (45 of 73) for those with less bother. Complications and re-treatment rates were low. Nielsen and colleagues (263) provided some evidence that the improved symptomatology is maintained in most patients for more than 7 years. In every series, some patients' symptoms are unaffected by the prostatectomy, and some (3% to 12%) are worse. Although many have cautioned that patients with irritative as opposed to obstructive symptoms are at greater risk for poor results (175,203), an evaluation by Jorgensen and colleagues (175) failed to confirm this finding. Clearly, careful evaluation and selection are indicated in patients with predominantly irritative symptoms and may have accounted for the good results (90%) reported in this latter group of patients.

Postprostatectomy urodynamic evaluation usually demonstrates a marked shift in the various urodynamic parameters, including an increase in maximum urine flow rate and voided volume and a decrease in residual urine and voiding pressure that would be anticipated if a mechanical or functional outlet obstruction were diminished or relieved (3,203,263). The mean improvement in maximum flow rates in the BPH guidelines review was 14.4 mL per second after open prostatectomy and 9.8 mL per second after TURP, far greater than any other treatment analyzed except TUIP (approximately 7.3 mL per second). Current assessments tend to interpret the initial and posttreatment postvoid residual determinations with uncertainty and caution. Voiding is usually almost complete in normal individuals, and failure to approximate this normal state with treatment should be documented. Even with the casual way in which the data analyzed were accumulated, the mean posttreatment postvoid residual was less than 25 mL for TURP and open prostatectomy in the BPH guideline literature review (230). Reversal of some of the preoperative urodynamic abnormalities is much less predictable (Table 32.7). Furthermore, normalization or marked improvement of the preoperative urodynamic abnormalities does not necessarily correlate with a satisfactory clinical outcome. The role of urodynamic evaluation in the routine selection and monitoring of patients subjected to prostatectomy is not clearly established (79). However, use of these procedures as a part of preoperative assessment of patients with a symptom complex of equivocal etiology or with a postsurgical result that is less than expected or optimal is gaining increasing acceptance. The selective inclusion of synchronous video pressure-flow cystometry promises to enhance the useful information derived from these studies (324).

TABLE 32.7. COMPARISON OF PREOPERATIVE CYSTOMETROGRAMS IN PATIENTS FOLLOWING PROSTATIC SURGERY